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THE ASCENT OF MAN.*

BY FRANK BAKER.

I think I could turn and live awhile with the animals—they are so placid and self-contained.

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They bring me tokens of myself * * *
I do not know where they got those tokens,
I must have passed that way untold times ago and negligently dropped them,
Myself moving forward then and now and forever.

Walt Whitman—1855.

The science of anthropology, one of the younger daughters of human knowledge, is so vast in its scope that to master all of its different ramifications seems a hopeless task. Having for its object the comprehensive study of man, including his origin, his development, and his present condition, its aim is to focus and co-ordinate the general results derived from a vast number of subordinate branches. The philologist contributes information concerning the origin and growth of language and its effect upon civilization, the mythologist tells of the psychological side of the human mind and traces the rise and progress of religious ideas, the archæologist, in order to fix their places in the history of mankind, searches for the remains of peoples long since passed away. All these depend for their material upon external records, left by tradition, by writing, by sculpture, or by implements and weapons.

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With greatest care every habitation of man is searched in order to learn from it the details of the life of its former inhabitants.

Within comparatively recent times still another avenue of information has been found, for we have learned that it is not alone by these external records that man's history can be traced, but that important facts may be obtained by studying the constitution of his body; that the changes and vicissitudes of his existence are recorded on his very bones, in characters long undeciphered but to which the clue has at last been found. My labors have led me more particularly to this department of anthropology, and a concise summary of the main heads of this research may be of value and interest.

The views propounded by Lamarck in the early part of this century, with reference to the modification of living organisms by use and adaptation, have been remarkably confirmed in modern times. Exhaustive researches into the constitution and properties of the cells composing living tissues show that they are subject to continual change, each impulse from without being registered by some small alteration in their physical condition. Impulses of a similar kind continuously acting produce greater changes, and long-continued repetition notably alters even the hardest and most enduring of structures. Thus it is that bones are modified in form by muscular pull, and the surfaces of teeth are shaped by incessant grinding. These alterations are more readily apparent to us because they affect very hard and easily preserved organs, but the effects are equally potent, though not so clearly recognizable, in the softer tissues of the body. Every act of our lives is certainly but surely registered within the marvelous structure of our bodies. Not a muscle can contract without an absolute change in its substance; not a nerve-cell can discharge without some self-destruction.

Most of these changes being very minute and evanescent are quite beyond our power to accurately estimate, and were the increments of change confined to a single lifetime—were each individual to stand only for himself and compelled to earn his experience by the same tedious struggle—use and adaptation would have but little power to mold mankind into races and varieties. But by the action of a law as yet imperfectly understood, the adaptations of each individual are transmitted to its offspring; or, to speak more accurately, the offspring pass through the changes more easily and quickly than the parent did. While each has always to go back to the be-

ginning and commence from the simple blastema of the primitive egg, the younger has the advantage of being able to adapt itself more quickly to its surroundings, provided these have not too greatly changed, and thus starts a little way ahead of its ancestor in the race for life. In consequence of this law changes become cumulative, and a cause acting for a great length of time upon a series of successive generations finally produces a well-marked and easily observed effect in the structure of individuals—changing colors, modifying organs, shaping whole regions of the body.

Again, if, after such changes have been effected, these causes cease to operate and the organs they have shaped are no longer of use, the latter become reduced in size, atrophy and recede, remaining, however, in a vestigial condition for many, many generations as records of the past history of the race, as dolmens and cromlechs certify to former customs and flint arrow-heads and stone hatchets give evidence of a previous state of civilization.

The human body abounds in testimony of this sort—indications of the pathway by which humanity has climbed from darkness to light, from bestiality to civilization—relics of countless ages of struggle, often fierce, bloody, and pitiless.

These are found in every organ of the body, and each new investigation adds to their number. To enumerate them all would be impossible within the limits assigned me by your patience. I will therefore touch only upon a few of the more striking ones, especially those connected with the modifications of the limbs, with the erect position, and with the segmentation of the body.

The limbs, being organs of support and locomotion, show great variations in the zoological series, and the hand of man has long been looked upon as especially significant of his high position in the animal kingdom—one of the chief distinctions between him and the nearest brutes. To a certain extent this is correct. No creature possesses so highly complex and effective an organ for grasping and adjusting objects, and it is pre-eminently this that has made man a tool-using animal. On comparing a human hand with that of the anthropoids it may be seen that this efficiency is produced in two ways—first, increasing the mobility and variety of action of the thumb and fingers; second, reducing the muscles used mainly to assist prolonged grasp, they being no longer necessary to an organ for delicate work requiring constant readjustment. Thus some elements are added and some

taken away. Now, according to the theory I have enunciated, the latest elements ought to show signs of their recent origin—to be somewhat imperfectly differentiated and liable to return to their primitive state, while those going out of active use ought to be vestigial, not equal in size or force to muscular organs generally, very liable to variation or disappearance. This is what actually occurs.

Among the new elements is a special flexor muscle for the thumb arising high up on the fore-arm. A very slight examination shows that this muscle has been split off from the fibres of the deep flexor that bends the terminal joints of the fingers. In most apes the two form a single muscle, and in man the thumb flexor very often shows unmistakable evidence of such origin. In about 10 per cent. of persons part of its fibres pass over and become blended with the parent muscle. Not infrequently I have seen the two entirely united, returning absolutely to their primitive condition. The deep and superficial flexors of the fingers show signs of a similar relationship, as they frequently blend more or less, tending to revert to the type shown in most lower animals. Indeed, if we go back to embryonic life we find all the muscles of the anterior part of the fore-arm united in what is termed the pronato-flexor mass, recalling the original condition of musculature in the earliest animals possessing limbs.

In the category of disappearing muscles comes the palmaris longus, an important aid in climbing and grasping. It takes its origin from the upper arm and passes to the hand, where it expands into a large sheet of thick membrane called the palmar fascia, which splits into several slips passing to each finger. The pull of the muscle acts upon all the fingers together, keeping them bent without independence of action. Now in man the fingers have each two separate flexor tendons that can act to a certain extent independently. To ensure their independence they are, at the wrist, enclosed in a remarkable tubular conduit or subway formed by soldering the palmar fascia to the wrist-bones. This at once destroys any effective action of the palmaris longus on the fingers and it becomes a flexor of the wrist. This soldering undoubtedly took place because the muscle was no longer required as a finger-holder. Like other organs that after playing a considerable part have come from change of habit to be of but little value, it shows the most astonishing tendency to variation. Not a week passes in a large dissecting

room that some curious anomaly is not found in this muscle. Sometimes it is seen almost in its primitive condition, the palmar fascia being comparatively movable and the palmaris longus having some effect upon the flexion of the fingers; oftener it unites wholly or partially with some portion of the pronato-flexor mass or disappears altogether. The disappearance is usually only apparent, however. Regressive structures rarely disappear totally, for on careful search a strip of fascia can usually be found that represents the atrophied and aborted organ.

Since these two examples differ in that the first represents the development of a new muscle while the second is the atrophy of an old one, we ought to find racial differences corresponding to these two conditions. Our studies of racial anatomy are as yet far from sufficient to give us certain information upon these points, and I would especially avoid generalizing upon too meagre data. It has, however, appeared to me that in negroes the palmaris longus is more inclined to assume its primitive type—that is, to be less likely to vary—while the long flexor of the thumb is, on the contrary, more inclined to be partially if not wholly united with the deep flexor of the fingers.

Connected intimately with the hand are the other portions of the thoracic limb that carry it from place to place. Here again we may note many points indicating a progressive development of the member. When the arm is naturally and easily bent at the elbow it does not carry the hand to the shoulder, as might be expected, but towards the mouth. The reason for this is that the articular surfaces of the elbow-joint are not cut horizontally across the axis of the humerus but inclined at an angle of about 20°. This obliquity does not occur in the fœtus and is less in Bushmen, Australians, and the anthropoid apes. It is associated with another peculiarity; indeed, may be said to be caused by it. This is a twisting of the humerus on its axis, which occurs markedly in the higher races. If we hold up endwise the humerus of a European we see that the longest diameters of the upper and lower ends very nearly coincide. In the negro we find the lower diameter turned more towards the body; still more in the anthropoid apes, and again more as we descend the scale. Embryology teaches that the humerus was formerly set so that the hollow of the elbow looked backward rather than forward, and it seems, therefore, that, as the functions of the limb became more various, the lower end of the

bone gradually twisted outward around the long axis until its diameter described a considerable arc. This turned the hand with the palm to the front, extended its range and adapted it for a wider usefulness. Greater twist is found in the right humerus than in the left and in the humeri of modern times than in those of the stone age. As the torsion increased some provision became necessary for carrying the hand easily across the body to the mouth. This was effected by the inclination of the trochlear surface of the elbow-joint already adverted to.

Many movements of the arm in man are produced by muscles acting upon the shoulder-blade or scapula. As the hand was turned outward and a wider range given, these increased in extent and importance, and the scapula accordingly widened out at its vertebral border in order to give a more extensive attachment for muscles. In order to accurately estimate this change the ratio of the breadth to the length of the scapula is taken. This ratio, called the scapular index, is highest among the white races, less in the infant, in negroes, and in Australians, and still less in anthropoid apes. It is significant also that the vertebral border of the scapula is the last to form in the fœtus. We have, therefore, three modifications—the torsion of the humerus, the inclination of its trochlear surface, and the scapular index—all depending upon each other, all varying together *pari passu*, and all showing a progressive development both in the individual and the race.

Muscle is composed of one of the most highly organized and expensive tissues of the body. Unless fed constantly with a great supply of blood to keep up its active metabolic changes, it quickly wastes, functional activity being absolutely necessary to its proper maintenance, as any one knows who has seen how rapidly the muscles of an athlete diminish when he goes out of training. If from accident or change of habit its use altogether ceases, its protoplasm is gradually removed, its blood-supply diminishes, and it shrinks to a mere band or sheet of fibrous tissue. Changes of function may therefore affect the form of muscles, one portion becoming tendinous or fascia-like; may even cause them to shift their places by inducing a development on one side and an atrophy on another, or to disappear altogether, replaced by fascia or ligament. A similar regression may take place in bone and cartilage, a high grade, actively metabolic tissue, difficult to maintain, being replaced by a low grade one comparatively slow to change. It is,

therefore, not unusual to find that muscles, bones, and cartilages performing important functions in some animals are represented by vestigial structures in those higher in the scale. Our conclusions on this subject are confirmed by finding occasional instances where the hereditary tendency has been greater than usual and the parent form is reproduced more or less completely in the higher animal. The palmar fascia at the distal end of the palmaris longus, to which allusion has been made, represents a former muscular portion, relics of which probably remain as some of the small thumb muscles.

Another interesting instance is the epitrochleo-anconeus, a small muscle at the elbow-joint, used in apes to effect a lateral movement of the ulna upon the humerus. In man the ulna has become so shaped that the lateral movement is almost totally lost, and the muscle has accordingly degenerated, being represented by a strip of fascia. Very often, however, a few muscular fibres are still found in this situation.

Several minor peculiarities that remind us of primitive conditions occur in the region of the humerus. Occasionally a supracondyloid process is found throwing a protecting arch over the brachial artery and median nerve; in this resembling the supracondyloid foramen of marsupials. Struthers found this to be hereditary, occurring in a father and four children. A perforation of the olecranon fossa may probably be regarded as a reversion towards the condition of anthropoid apes. This frequently occurs in South African and other low tribes and in the men of the stone age. Recently Dr. D. S. Lamb has found it remarkably frequent in prehistoric Indian humeri from the Salado Valley, Arizona.

While the region of the hand and fore-arm indicates increased of specialization, the upper part of the limb generally testifies to a regression from a former more highly developed state. The anatomy of the flying apparatus of a bird shows a series of muscular, ligamentous, and bony structures connected with its upper arm far beyond anything ever seen in man. The coracoid bone, a very important element of the shoulder girdle in birds, has become reduced in man to a little vestigial ossicle that about the sixteenth year becomes soldered to the scapula as the coracoid process. The muscles arising from this—pectoralis minor, coraco-brachialis, and biceps—are structures represented in birds by strong, flying muscles. The subclavius, a little slip ending at the clavicle, appears to have formerly passed to the coracoid bone or to the humerus and been

employed in arm movement. The pectoralis major appears to represent what was formerly a series of muscles. All these have a tendency to repeat their past history, and the number of variations found among them is legion. The biceps shows traces of its former complexity by appearing with three, four, or even five heads, by a great variety of insertions, by sending a tendon outside the joint capsule instead of through it, as is the rule. The pectoralis major may break up into several different muscular integers, inserted from the shoulder capsule down to the elbow. The coraco-brachialis shows the same instability, and by its behavior clearly indicates its derivation from a much larger and more extensive muscular sheet.

Not less significant are the ligaments about the shoulder. Many of these appear to be relics of organs found active in animals lower in the scale. Thus the coraco-acromial ligament spanning over the shoulder-joint is probably a former extension of the acromion process; the rhomboid, conoid, trapezoid, and gleno-humeral ligaments represent regressive changes in the subclavius muscle, the coraco-humeral ligament, a former insertion of the pectoralis minor. Bands of the deep cervical fascia alone remain to testify to the former existence of the levator claviculæ, a muscle present in most mammals and used to pull forward the shoulder girdle when walking in a quadrupedal position. In negroes I have frequently found it more or less complete. A fibrous strip uniting the latissimus dorsi to the triceps is all that remains of an important muscle, the dorso-epitrochlearis, passing from the back to the elbow or fore-arm, used by gibbons and other arboreal apes in swinging from branch to branch. Testut found this fully developed in a Bushman. I have myself seen various muscular slips that must represent some portion of it, and authors generally describe it as occurring in 5 or 6 per cent. of individuals.

The hind limbs of apes are popularly thought to be remarkably specialized. The term quadrumana or four-handed is used to characterize the class; yet it is quite true that this term involves a false conception. No animal has four exactly similar feet, still less four hands. The feet of the ape differ widely from hands; the great toe is not really opposable like the thumb, but merely separable from the others and differently set, so as to afford a grasp like that of a cramp-iron. The gibbon alone has a small muscle of the foot that may be compared with the opponens of the thumb. That these peculiarities are also shared by man to some extent is also well

known. It is quite possible to train the toes to do a certain kind of prehensile work, even to write, cut paper, and sew. A baby not yet able to walk can often pick up small objects with its toes. Compare the marks caused by muscular action on the sole of a baby's foot with those on the hand, and it will be seen that there are distinct signs of this prehension. Even the opponens hallucis of the gibbon is not infrequently found in man. The fœtal condition of the foot also approaches that of the apes, the heel being shorter and the joints so arranged that the sole can be easily turned inward. In the ape the first or great toe is turned backward and outward by shortening its metatarsal bone and setting it obliquely upon the ankle. This shortening and obliquity also occur in the fœtus; the adult condition, in which the metatarsal bone is lengthened and set straight so as to give a longer and firmer internal border to the foot, being gradually acquired. Many savage tribes still use the foot for climbing and have a shorter metatarsal, a wider span between the first and second toes, and greater ease in inverting the sole. Connected with this ease of inversion should be mentioned a peculiar, ape-like form of the tibia that occurs in people of the stone age, in the mound-builders, and in some American Indians. This is a flattened, sabre-like condition of the bone known as platycnemy. It is apparently to give greater surface of attachment and resistance to the pull of the tibialis anticus, the principal muscle that turns the sole inward. It is interesting to note that this peculiarity is much more marked in some early human skeletons than in any of the anthropoids.

The poet says that while other animals grovelling regard the earth, Jupiter gave to man an uplifted countenance, and ordered him to look heavenward and hold his face erect towards the stars.

> "Pronaque cum spectent animalia cetera terram,
> Os homini sublime dedit, cœlumque tueri
> Jussit, et erectos ad sidera tollere vultus."*
>
> *Ovid, Metamorphoses: I, 84–86.*

* Compare Milton:

> "A creature who not prone
> And brute as other creatures, but endued
> With sanctity of reason, might erect
> His stature, and upright with front serene
> Govern the rest, self-knowing."
>
> *Paradise Lost: VII, 506–510.*

The erect position is, however, gradually acquired. As in the sphinx's riddle, we literally go on all fours in the morning of life, and the difficulty that an infant experiences in learning to walk erect is strong evidence that that is an accomplishment acquired by the race late in its history. We ought, if this is the case, to find in the human body indications of a previous semi-erect posture. There is a vast amount of evidence of this character, and I can only sketch the outlines of it.

The erect position in standing is secured by the shape of the foot, by the attachment of strong muscles at points of severest strain, and by the configuration of the great joints which permits them to be held locked when a standing posture is assumed. All these features are liable to great variation; they are less marked in children and in the lower races. Let us examine them somewhat more carefully.

The Caucasian type of foot is evidently that best adapted for the erect position. The great toe is larger, stronger, and longer than the others, making a firm support for the inner anterior pier of the arch formed by the bones—an arch completed by a well-developed heel and maintained by a strong dense band of fascia and ligament binding the piers together like the tie-rod of a bow-string truss—thus producing a light and elastic structure admirably adapted to support the weight of the body and diminish the effect of shocks. In the lower races of man all these characters are less marked. The great toe is shorter and smaller, the heel-bone less strongly made, the arch much flatter. This flattening of the arch produces the projection of the heel found in some races.

The muscles required for maintaining the erect position are those which from our predilection for human anatomy we are apt to call the *great* extensors, overlooking the fact that in other animals they are by no means as well developed as in man. Being required at the points of greatest strain, all are situated on the posterior aspect of the body—the calf, the buttock, and the back.

A very slight examination of any lower animal will show how strikingly it differs in the muscular development of these regions. The great muscle of man's calf, the triceps extensor suræ, is formed by the welding together of some four muscles separate in many lower forms. Varieties are found in man showing all grades of separation in these elements. One of the muscles, the plantaris, was formerly a great flexor of the toes, the plantar fascia representing its former distal extent. Like the palmaris of the arm it lost

its original function by the welding of the fascia to the bones to secure the plantar arch, and its functions being then assumed by other muscles it began to dwindle, and is now represented by a mere vestigial rudiment of no functional value. It is well known that the lower races of men have smaller calves than Europeans. Again, it should be noted that as the erect position is assumed the muscles required for the flexion and independent action of the toes become reduced in character. A comparison with other forms shows that some of the small muscles now confined to the region of the foot formerly took their origin higher up, from the bones of the leg. Losing in functional importance, they have dwindled in size and gradually moved downward.

The great glutæi muscles of the buttock find their highest development in man. They are subject to similar variations. Certain muscles of this region, normal in apes, are occasionally found in man—a separate head of the great glutæus, derived from the ischium, and the scansorius, or climbing muscle, that assists the great flexor of the thigh (the ilio-psoas) may be mentioned.

The enormous size and complexity of the muscles of the back in man are well known. The erector of the spine fills up the vertebral grooves and sends up tendons along the back like stays supporting the masts of a ship. The mass of this muscle is comparatively less in anthropoids.

Notwithstanding all these powerful muscles, it would be impossible to retain the erect position for any great length of time were we to depend upon them alone, for it requires as before stated, a great expenditure of force to keep a muscle in active use. It becomes rapidly fatigued and then loses its power, as any one may prove by standing in any constrained position, even "in the position of a soldier," for half an hour. To provide against this a beautiful arrangement of joints and ligaments has been developed.

When in the erect attitude the ankle-joint is so arranged that its bones are in a position of greatest stability, and the center of gravity is so adjusted that it falls directly upon it. This reduces to a minimum the amount of muscular force required to keep the body erect. At the knee the center of gravity falls a little in front of the axis of the limb, and the back and sides of the joint are provided with check ligaments or straps that hold the joints locked in a position of hyper-extension, so that no muscular force whatever is used to maintain it. These ligaments are regressive structures, being ves-

tiges of former insertions of muscles near the joint. At the hip a similar condition occurs, the center of gravity falling behind the joint and the whole weight of the trunk being hung upon the ilio-femoral ligament. This structure is much more marked in man than in other mammals, and is found to vary considerably in its size and strength.

The spinal column has been remarkably modified to adapt it to the erect position. Before the fifth month of uterine life the whole spine describes a single, large, dorsally directed curve like that of the quadruped, arranged to accommodate the viscera. As this would be incompatible with the erect posture, two additional curves in the opposite direction are formed—one in the region of the loins just where the center of gravity would begin to fall forward, another in the neck to counteract the heavy and unstable weight of the head. These curves are gradually acquired. While possessed by all races, and in a less degree by the higher apes, they arrive at their highest development in Europeans. Careful measurements show that the shapes of the vertebræ have been gradually modified. There is no abrupt transition from the spine of the lowest savages—Australian, Bushman, Andaman—to that of the gorilla, gibbon, and chimpanzee; and the lnmbar curve of the lower races of men is much better adapted to running in a semi-erect position through the jungle or bush.

There is also evidence that the posterior limbs have moved forward upon the spinal column in order that the erect position may be assumed with less effort. In man there are between the skull and the sacrum twenty-four vertebræ. The other primates have usually twenty-six, although the gorilla, chimpanzee, and orang agree with man. Now in fœtal life the attachment of the hip-bones to the sacrum commences from below upward. Union first occurs with the third sacral vertebra, leaving twenty-six presacral, then advances forward, the first sacral uniting last of all. The hip-bones actually move up along the spine a distance of two segments. Occasionally this shifting is carried still farther, and but twenty-three presacral vertebræ are left. Anomalies caused by an arrest of development at some stage of this process are not at all infrequent. The most common is the want of union between the hip-bones and the first sacral vertebra, thus producing apparently six lumbar vertebræ. A most beautiful specimen of this anomaly was found last winter in my laboratory.

The spine is sustained erect by stringing from vertebra to vertebra numbers of short ligaments that reduce to a minimum the muscular exertion required to support it. These are particularly numerous between the spines along the great dorsal curvature. Some of these ligaments are replaced by small muscles, very inconstant and variable, the survivals of a whole system of musculature that had for its object the moving of the separate joints of the spine, one upon another.

The head is also much modified by the erect position. In quadrupeds its suspension requires an extensive apparatus, a large, strong, elastic strap—the ligamentum nuchæ—passing from the tips of the thoracic vertebræ to the occiput, sending processes to all the neck vertebræ involved in the strain. Though need for it has in great degree ceased, since the head has become poised in such a way as to involve but little expenditure of muscular force, yet relics of this great suspensory apparatus remain in man's neck in the form of thickened fascial bands.

The arrangement of the great foramen of the skull that transmits the central axis of the nervous system, the spinal cord, is necessarily different in an animal carrying its head erect. The foramen would naturally tend to be set forward, more under the center of gravity, and its inclination would be more nearly horizontal. Here again we see that the ideally perfect form is more nearly approached in the civilized races. It is never quite realized, and indeed the whole skull and its contents evince markedly that they are still undergoing an evolution. Again the lower races show variations that unite them with the anthropoids. While a negro may have a foramen magnum inclined 37° to the horizontal, the orang may fall to 36°.

But it is not only in this way that we get evidence that the erect position has been gradually acquired. Since gravity plays an important part in the functions of the visceral and circulatory systems, any marked change in the line of equilibrium must necessarily be accompanied by disturbances. These disturbances, to a certain extent, conflict with the acquirement of the position; as they weaken the animal. In the course of time the body may perhaps become adapted to the changed conditions, but before that perfect adaptation takes place there is a period of struggle. There is abundant evidence that such a struggle has occurred and is yet going on; the adaptation being as yet far from complete.

The most striking and important of these adaptations concerns the pelvis. When the erect posture is assumed, the weight of the viscera being thrown upon this bony girdle, it becomes adapted for their support by becoming more fixed and dish-like in shape. This is naturally more pronounced in the female, since with her the pelvis must bear the additional weight of the pregnant uterus. It is evident that a solid, unyielding, laterally expanded ring of small aperture would give the most effective support in the erect position, but it is equally clear that with any such structure parturition would be impossible. In the quadruped the act of parturition is comparatively easy, the pelvis offering no serious hindrance. The shape of the female pelvis is therefore the result of a compromise between two forms—one for support, the other for ease in delivery. When we reflect that along with the acquirement of the erect position the size of the head of the child has gradually increased, thus forming still another obstacle to delivery and to the adaptation which might otherwise have taken place, we can realize how serious the struggle has been, and no longer wonder that deaths in child-birth are much more common in the higher races, and that woman in her entire organization shows signs of having suffered more than man in the upward struggle.

In no other animal is there shown such a distinction between the pelvis of the male and that of the female—a distinction that increases as we ascend the scale. While the amount of individual variation is great, we yet see, particularly in the pelvis of the Andaman Islanders and of the Polynesian races, distinctly anthropoid characters. The scanty material at hand indicates that a similar transition occurred between the modern and prehistoric types. The approximation of the infantile and simian forms is well known.

The pelvis alone does not suffice to support the viscera. In quadrupeds the whole weight is slung from the horizontal spine by means of a strong elastic suspensory bandage of fascia, the tunica abdominalis. The part of this near the thorax has in man entirely disappeared, being no longer of any use. In the groin it remains to strengthen the weak points where structures pass out from the abdominal cavity. That it often is insufficient to withstand the great pressure is testified by the great prevalence of hernia, another sign of imperfect adaptation. The frequency of uterine displacements, almost unknown in the quadruped, has also been noted. It is significant that one of the most effective postures for treating and

restoring to place the disturbed organ is the so-called "knee-elbow position," decidedly quadrupedal in character.

Many other indications are found in the viscera. The urinary bladder is so arranged in man that any concretions do not gather near the opening of the urethra where they might be discharged, but fall back into the cul-de-sac at the base, where they enlarge and irritate the mucous lining. The cæcum, with its vermiform appendage, a vestigial organ finding its proper functional activity far below man, is so placed in quadrupeds that the action of gravity tends to free it from fœcal accumulations. In man this is not the case, and as a consequence inflammation of this organ or its surrounding tissues, very serious and often fatal, is by no means rare. It may be noted that the ascending colon is obliged to lift its contents against gravity, and that in a lowered state of the system this might very readily induce torpidity of function.

The gall bladder in quadrupeds also discharges at an advantageous angle. In man, although the difference is slight, it appears to be sufficient to cause at times retention and consequent inspissation of the bile, leading to the formation of gall-stones.

The quadruped's liver hangs suspended from the spine, but as the erect attitude is assumed it depends more and more from the diaphragm. The diaphragm in its turn develops adhesions with the fibrous covering of the heart, which is continuous with the deep fascia of the neck, so that in effect the liver hangs suspended from the top of the thorax and base of the skull. This restricts in some degree the action of the diaphragm and confines the lungs. This must have an effect upon the aeration of the blood, and consequently upon the ability to sustain prolonged and rapid muscular exertion. An extra lobe of the right lung that in animals intervenes, either constantly or during inspiration, between the heart and the diaphragm, is occasionally found in a vestigial state in man.

The vascular system abounds in evidences that it was primarily adapted to the quadrupedal position. By constant selection for enormous periods of time the vessels have become located in the best protected situations. It is scarcely possible to injure a vessel of any size in an animal without deeply penetrating the body or passing quite through a limb. In man, on the contrary, several great trunks are comparatively exposed, notably the great vessels of the thigh, those of the fore-arm, and of the ventral wall.

The influence that gravity has upon the circulation is well known.

The horizontal position of the great venous trunks favors the easy flow of blood to the heart without too greatly accelerating it. Man, in whom these trunks are vertical, suffers thereby from two mechanical defects—the difficulty of raising blood through the ascending vena cava, whence come congestion of the liver, cardiac dropsy, and a number of other disorders, and the too rapid delivery through the descending cava, whence the tendency to syncope or fainting if for any cause the action of the heart is lessened. Clevenger's admirable discovery that the valves of the veins are arranged for a quadrupedal position should also be mentioned here. Evidently intended to resist the action of gravity, they should, to be effective, be found in the large vertical trunks. But in the most important of these they are wanting; hence are caused many disorders arising from hydrostatic pressure, such as varicose veins, varicocele, hæmorrhoids, and the like. Yet they occur in several horizontal trunks, where they are, as far as we know, of no use whatever. Place man on all fours, however, and it is seen that the entire system of valves is arranged with reference to the action of gravity in that position. The great vessels along the spine and the portal system being then approximately horizontal do not require valves, while all the vertical trunks of considerable size, even the intercostal and jugular veins, are provided with them. A confirmation of this view is found in the fact that the valves are variable in character and tend to disappear in the veins where they are no longer needed.

Every animal possessing a back-bone may be said to consist of a series of disc-like segments, arranged on a longitudinal axis. These segments are originally similar in character, but become specially modified in innumerable ways to meet the needs of the individual. Anatomists conclude, upon surveying the whole field, that this indicates a derivation of the vertebrates from some form of the annelid worms, among which a single unit produces by successive budding a compound longitudinal body. This view is fully confirmed by the behavior of the human embryo.

The number of the segments varies considerably, rising sometimes to as many as three hundred in some fishes and reptiles, and being generally greater in the animals below man. There are many indications, however, that in man, segments formerly possessed have disappeared. Leaving the skull for the present out of account, there are in the adult thirty-three or thirty-four vertebræ that may

be held to represent these segments; the additional vertebra, when it occurs, almost invariably belonging to the coccygeal or caudal series. In the human embryo thirty-eight segments can at one time be made out. Four or five of these generally disappear, but cases are by no means wanting in which they remain until after birth and constitute a well-marked free tail. In one case, carefully examined and described by Lissner, a girl of twelve years had an appendage of this character 12.5 centimeters long. Other observers, probably less careful and exact, report much greater lengths. From some observations it would appear that abnormities of this kind may be transmitted from parent to offspring.

Dr. Max Bartels recently collected from widely scattered literature reports of 116 actually observed and described cases of tailed men. In 35 instances authors reported such abnormities to be possessed by an entire people, they themselves having observed certain individuals. These cases are scattered throughout the whole of the known globe and extend back for a thousand years. When we consider that the authenticity of many cases is beyond question, and that the number that escaped accurate observation and report must be much greater, we can see that we are not dealing with so rare a phenomenon as would at first be supposed.

Other regressive structures are abundant in this region. The spinal cord in its earlier state extended the entire length of the vertebral canal. In the child at birth it occupies only 85 per cent. of that length; in the adult 75 per cent. This is due mainly to the more rapid growth of the spine. There stretches, however, from the lower end of the cord down to the very end of the spine a small thread-like structure, the filum terminale, a degenerated vestige of the lower caudal part of the spinal cord. Wiedersheim suggests that the frequent occurrence of degenerative disorders in the lower end of the adult cord may be due to a pathological extension of the normal atrophy. Rauber found in this region traces of two additional pairs of spinal nerves. The vessel that runs down in front of the sacrum and coccyx corresponding to the caudal artery of quadrupeds shows signs of a former more extensive distribution, as it ends in a curiously convoluted structure known as the coccygeal gland, containing vestiges of vascular and nervous tissues. Traces of caudal muscles still remain, notably the ischio-coccygeus, which in animals moves the tail sideways, and the anterior and posterior sacro-coccygeus, for flexing and extending it. Occasionally the

agitator caudæ is found as a muscular slip passing from the femur to the coccyx. These muscles cannot be of any value in man, as the coccyx is practically immovable. At the point where the end of the spine was primarily attached to the skin a dimple is formed by regressive growth, and here the direction of the hairs also shows an aborted organ.

Another interesting condition connected with segmentation is the varying number of ribs. Most mammals have more ribs than man, and as we descend in the scale they continue to increase. A study of development indicates that a rib is probably to be considered as an integral portion of a vertebra. As the arch of a vertebra encloses the central nervous system, so the ribs enclose the visceral system. If this be correct they ought to be found throughout as far as the body cavity extends. This is really the case. They exist in the neck as the anterior bars of the transverse processes, in the loins as the transverse or costal processes themselves, in the sacrum welded together into what are known as the lateral masses. A great number of considerations derived from comparative anatomy, from embryology, and from variations found in the adult combine to support these conclusions.

Nothing would seem less likely at first sight than that the capacious expanded brain-case or skull with its complicated structure should be composed of segmental pieces like the vertebræ; yet there is no doubt that the poet Goethe was on the right track when he made that important generalization. The details of the segmentation are very far from being worked out, but a vast amount of evidence indicates that the general conclusion is correct.

Since the predominant necessity in the construction of the skull is to afford a protection for the brain, we need not be surprised to find that it is very greatly modified in man. Enormous labor has been bestowed upon craniology in an attempt to separate definitely the races of men as well as to connect them with the lower forms. The success in establishing races has not been such as was anticipated. A constant intergrading of forms defies all attempts at a hard and fast classification. We also see types that intergrade between anthropoids and man, and find abundant evidence that the human skull was derived from a form similar to that of still lower mammals.

At first man's skull seems to be much simpler than the typical form. The bones are fewer and less complicated. But follow back

the course of development and we find the bones separating—the frontal into two pieces, the occipital and temporal each into four, the sphenoid into eight, repeating what we find as we descend the vertebrate scale.

Many of these peculiarities may remain throughout life. Such are the interparietal bone, found very frequently in ancient Peruvian and Arizonian skulls; the division of the frontal and temporal bones each into two, the persistence of the intermaxillary bones and of that division of the cheek or malar bone known as the os japonicum. Even cleft palate, a deformity and defect in man, merely reproduces a state natural to some of the lower mammals.

There are also present structures that are homologous with the so-called visceral arches represented in the thorax by ribs. Such are the lower jaw, the hyoid bone, and the thyroid cartilage. A study of the embryo shows us that these are portions of a series of bars primitively arranged on the plan of the branchial apparatus of the water-breathing vertebrates. Each bar has its appropriate skeleton and vascular supply, and is separated from the contiguous ones by a cleft that at first passes entirely through the soft tissues and communicates with the primitive visceral cavity. These clefts may persist and cause serious deformities. The skeleton of the mandibular and hyoid bars is remarkable as containing indications of elements present in the lower vertebrates. In fishes the lower jaw articulates with a large bone apparently not found in mammals, but on tracing carefully the development of the mammalian skull it is found that this bone is represented by the incus, one of the minute ossicles of the ear. In the fœtus the primitive lower jaw, in the shape of a bar of cartilage, actually extends into the ear cavity and the upper end of it remains as the malleus. Relics of the hyoid or second branchial arch are also found—the styloid process of the temporal bone being one of them.

The capacity of the cranium is usually held to distinguish man remarkably, yet the lowest microcephali approach the apes in this respect, and the lower races have unquestionably smaller brains than the higher. As far as can be judged, there has also been an increase in average capacity during historic times. One fact pointed out by Gratiolet is very significant. In monkeys and in the inferior races the ossification of the sutures commences at the anterior part of the head, while in Europeans these sutures are the last to close. This would indicate a greater and longer continued increase of the frontal lobes of the brain.

The same remarks may be made concerning the facial angle and prognathism. While by none of the different angles proposed have we been able to definitely separate distinct races, yet we find that the angle of the lower races and of microcephali approaches that of the anthropoids, and that as the capacity of the skull has increased the jaw has been thrust back under it to support the weight. This shortening of the jaw gives the characteristic expression of the civilized face. We at once recognize a brutal physiognomy by the projection and development of the great masticating apparatus, used in most animals near man as a formidable weapon of defense. The shortening has produced some very remarkable changes. It has shoved the third molar or wisdom tooth so far back that it is crowded against the ascending part of the jaw, thereby occasioning disturbance and trouble in its eruption. Being no longer practically useful, it tends to disappear, and many people never cut any wisdom teeth. Among the Australasians, on the contrary, a fourth molar is not infrequently found, and rarely in European skulls. Evidences also exist of a lost incisor in the upper jaw on each side. Dental follicles form for it and usually abort, but occasionally the tooth appears fully developed in the adult. The great canines or eye-teeth, used in apes and other animals for tearing and holding, are in them longer and larger than the other teeth, and room is made for them in the opposite jaw by leaving an interval, called the diastema, between the canine and the tooth next to it. These large projecting canines have disappeared in the normal human skull and the diastema has accordingly closed up. Yet it is by no means uncommon to see the whole arrangement reappear, especially in low-type skulls. Projecting canines or "snag teeth" are so common in low faces as to be universally remarked, and would be oftener seen did not dentists interfere and remove them. It may be noted also that the muscle that lifts the lip from over the canines and bares the weapon often reappears in man and is used in snarling and disdainful expressions.

Many details of structure of the skull point in the same direction. Occasionally the occipital bone has a third condyle as in some other mammals or a large lateral projection like that of a vertebra, the paramastoid process, or indications of a separate centrum (*os basioticum* of Albrecht). It may have interiorly a hollow (*fossette vermienne*) for the vermiform process of the cerebellum, and exteriorly a large transverse ridge (*torus occipitalis*) for the insertion of the muscles of the nape. All these peculiarities are more frequent as

we descend the scale, whether we regard the lower races of man, microcephalic individuals, or lower animals. Like many of these atavistic features they are also more common among the criminal classes.

I have omitted the discussion of many important structural features that mark various stadia in man's ascent. From the muscular system alone there could be adduced a very great number of instances of the survival of primitive forms and of progressive variations, particularly in the development of the muscles of the face and breast. In the osseous system also there are many such, among which may be mentioned the episternal bones, the central bones of the wrist and ankle, and the os acetabuli. The exact significance of these is still under discussion, as is also the question of supernumerary digits that sometimes appear on the hands and feet.

Additional instances might be drawn from the visceral system. The larynx contains small throat pouches like the great air sacs of the anthropoids. The pharynx of the embryo is lined with cilia like that of the very lowest vertebrates. Traces of the primitive intestine are shown by the peculiar distribution of nerves and the folding of the peritoneum. The liver and spleen both occasionally indicate a previous simpler condition, and the intestine has sometimes diverticula of no functional use—indeed, likely to be disadvantageous—yet pointing to a previous state. These anomalies never occur at random, but can be explained consistently upon the theory of reversion.

The genito-urinary system abounds in them. The uterus may have two cavities, as in many quadrupeds, or approach that condition by being bicornuate, as in apes, and a great variety of other vestigial structures occur, all pointing back to an original neutral condition, before the sexes were differentiated.

In the nervous system there is no lack of instances. Our studies of the brain are as yet far from complete—indeed, we seem to be only at the threshold of a reasonable knowledge of the nervous centers—and the crowd of names, the inextricable maze of synonymy that now obscures that region is only a mark of our ignorance. It is a case of "*omne ignotum pro mirifico*"—ignorant of the true value of the parts we examine, we have named even the most insignificant details of structure. Perhaps one of the most interesting results of modern research is the conclusion that the psychic life of our ancestors must have been different from our own, since they possessed

organs of sensation differing in degree and probably in kind. The sense of smell as indicated by the size of the olfactory bulbs of the brain is decreasing in acuteness. The fœtal brain posseses comparatively larger bulbs, as do also the brains of lower races and of anthropoids. The sense, being no longer required for the preservation of the species, is slowly becoming dulled. Jacobson's organ, a curious structure found in many mammals, combining in some unknown manner the olfactory and gustatory senses, occurs in a vestigial state in man, and the duct connecting it with the mouth yet remains as the anterior palatine canal. The pineal and pituitary bodies of the brain probably represent obliterated sense organs, the former being an eye, the latter having some connection with the pharynx. Our other senses have also been modified. The eye has a rudimentary third eyelid, such as birds and lizards possess, covered with minute hairs. The external ear shows signs of derivation from the pointed ear of quadrupeds and abounds in vestigial muscles such as they use for controlling and directing it.

From this rapid sketch it will be apparent to you that the evidence that man's path upward has led along the same route traveled by other animals is now very powerful in its cumulative weight. By no other argument can we satisfactorily explain the bewildering maze of resemblances; yet when called upon fix the exact line by which we have reached our present estate we at once meet with serious difficulties. It is a popular misconception that there has been a regular chain-like series, with now and then a "missing link." The various races of men and the anthropoids are merely one branch of the great tree Yggdrasil, that overshadows the whole earth and reaches up into heaven. The individuals that we compare occupy the terminal twigs of that branch, being not related directly but only as springing from a common stock. The fact that resemblances occur does not necessarily prove a lineal descent but rather a common ancestry. The races of man arose far back in prehistoric night. Each in its own way fought the struggle for existence. Favored more by climate, the Caucasian appears to have attained an intellectual superiority; yet it should not be forgotten that the others also excel, each in its own special way. The white races endure with difficulty the climate of the tropics, and without help would starve in the Australian bush and the Arctic ice-fields.

Notwithstanding all that I have said concerning reversive characters, we yet have hardly sufficient structural grounds for separating

the races of man. Different varieties of the Caucasian race show marked variations. Between the lowest and most brutalized laborers and the cultivated and intelligent classes there exist anatomical differences as great as those which separate the white and the negro. The rapid change in the African races, remarkably shown in America in the three generations now before us, is a more conclusive proof of inferiority, as it indicates that they have not had time to acquire fixed characters.

Again, as to the anthropoids, it is evident that they have widely diverged from man, and that none represent the primitive ancestor from which all were derived. The comparison of a human skull with that of an adult gorilla or chimpanzee is very striking. On the one hand we see all the structural features subordinated to the necessity of forming a capacious receptacle for the brain; on the other, a similar subordination for producing an effective fighting apparatus—jaws, teeth, and ridges for the insertion of powerful muscles. In one, intelligence predominates; in the other, force. The skulls of the young of all these species show, however, much greater resemblances than those of adults. This seems to indicate that there must have been a primitive common type from which all have diverged. Savages when ill-fed and living in unfavorable conditions may simulate the habits of anthropoids, and this has an effect upon their physical structure, yet not on that account should we too readily accept their close relationship.

In this summary, I have purposely refrained from any discussion of the physiological phenomena that necessarily accompany anatomical structure. Yet these are most important. Anatomy and physiology are inseparable, each being dependent upon the other. The results of the erect position, of increased size of brain, of greater specialization of limbs, are almost incalculably great; so great that they affect the whole life of the animal—control his habits, direct his actions in war and in the chase, and finally mold peoples, nations, and races.

As Cuvier was able to deduce an animal's habits from the shape of his teeth, so we may speculate as to man's past and future from an examination of his anatomy. *Ex pede Herculem* has not ceased to be true. It would be impossible for me to adequately treat of all these results in one short hour; the subject must necessarily be deferred to another time and another place. If I have succeeded in showing you that structural features form no insignificant part of anthropology my object is attained.

"GENS" AND "SUB-GENS," AS EXPRESSED IN FOUR SIOUAN LANGUAGES.—The American Anthropologist for April, 1888, contained an article, "Meaning of the words for Gens in the Iroquoian and Algonquian Tongues," by Mr. J. N. B. Hewitt. He states that in nearly all the Iroquoian languages the word for gens also signifies clay or mud, and he finds a like peculiarity in the Algonquian. This is not the case with the four Siouan languages under consideration.

In Dakota, gens is o-tshe'-ti, *fire-place;* hence, one of the names which the Dakotas have given themselves, O-tshe'-ti sha'-ko-win, *seven fire-places,* comprising the seven original gentes, now tribes, Mdewakantonwan, Wakhpekute, Wakhpetonwan, Sisitonwan, Ihanktonwan, Ihanktonwanna, and Titonwan. The sub-gens is ti-o-shpa-ye, *a group of those who camp by themselves.*

The Omaha and Ponka call the gens tan'-wan-gdhan u-ba'-nan or tan'-wan-gdhan u-ba'-te, *a village* or *group of people springing from a common stock*—banan *and* bate, referring to *a clump of trees* springing from a common root or stump. All the gentes are described as tan'-wan-gdhan ba-nan'-nan, or tan'-wan-gdhan ba-te'-te. But their terms for *sub-gens* are tan'-wan-gdhan u-ki'-gdha-sne, *a segment of a village,* or, *one of the parts into which a stump has been split* (u-ga-sne), and u-ne'-dhe, *a fire-place.*

The Kansa have the term tan'-man u-ki'-pa-te, sociative in form, and therefore applicable to the *sub-gens* rather than to the gens.

The Osage tell of the Tsi'-shu u-tse' pe-dhŭn'-pa, the Han'ka u-tse' pe-dhŭn'-pa, and the Wa-ca'-ce u-tse' pe-dhŭn'-pa, all twenty-one gentes being in the Osage nation or confederacy. U-tse means *fire-place,* and pe-dhŭ^{n}-pa *seven.* There are fully sixty-seven gentes and sub-gentes among the Osage, that number of names having been gained, but the name for sub-gens is still unknown to the writer. Another Osage term for "gens" is u-pa-tse, which corresponds to the Omaha and Ponka ubate.

The Tciwere tribes (Iowa, Oto, and Missouri) call a gens ki-kra-tshe, as, Wa-ka$^{n'}$ ki-kra'-tshe, *they call themselves* (*after a*) *Snake.* The name for *sub-gens* was not obtained, though each Iowa gens had four sub-gentes whose names have been recorded (excepting those of one gens), and there are still sub-gentes in one Missouri gens.

The Winnebago name for *gens* is i-ki'-ka-ra'-tsha-da, answering to the Tciwere kikratshe. Hence, Ta'i-ki'-ka-ra'-tsha-da, *the Deer gens.* No name for *sub-gens* has yet been found by the writer, though there are sub-gentes in the Bird gens. J. OWEN DORSEY.

EXCAVATIONS IN AN ANCIENT SOAPSTONE QUARRY IN THE DISTRICT OF COLUMBIA.

BY WILLIAM H. HOLMES.

Having completed the examination of the quartzite bowlder quarries on Piny Branch and Rock Creek, it seemed appropriate that some attention should be paid to the soapstone quarries of the neighborhood. It was hoped that a comparison of the methods of quarrying and manufacture and of the tools used in the two classes of quarries would throw some light upon the relationships of the peoples concerned and thus aid in the solution of one of the foremost problems of American archæology, the antiquity of man's presence here.

Deposits of soapstone occur at a number of points within the limits of the District of Columbia, but only one locality exhibits abundant traces of ancient working; this site is known as the Rose Hill Quarry and is situated on Connecticut Avenue extended, four miles from the Executive Mansion and three-fourths of a mile east of Tennallytown. It is distant about one and one-half miles from each of the great quartz bowlder quarries recently examined and partially described in the July number of this journal.

Steatite is of common occurrence over a wide belt of territory extending through the New England States and continuing down the Atlantic slope to Alabama. It is associated with the gneissic rocks and occurs in somewhat disconnected patches or areas, not yet fully traced by geologists. Outcrops have been worked in hundreds of places by the aborigines. More recently the whites have mined it extensively, and many of the quarries worked by the Indians have been disturbed and traces of the ancient work obliterated. In a few places observations have been made by scientific men, and many examples of the tools used and of the articles manufactured have been collected. The finest and most extensive collection of such objects is in possession of Mr. J. D. McGuire, of Ellicott City, Md., to whom I am greatly indebted for the privilege of their examination.

The Rose Hill Quarry seems to have been first studied by Dr. Elmer R. Reynolds, who published a careful description of the site and of the

articles collected by himself in the Thirteenth Annual Report of the Peabody Museum.* About that time visits to the site were made by Mr. F. H. Cushing, Dr. Charles Rau, Prof. O. T. Mason, and others, and extensive collections of articles, mainly from the surface of the ground, were made. Mention is made by Mr. Reynolds of excavations conducted by these gentlemen, but no definite information upon this point is on record.

A paper published by Louis A. Kengla, in 1883, gives considerable additional matter, accompanied by illustrations of fragments of vessels obtained in the District. †

The present notice is not intended to be an exhaustive study of the ancient work, as it is desired only to institute a comparison between these quarries and the other quarries of the District. The whole subject of the working of soapstone by our aborigines may well receive separate and exhaustive treatment.

TOPOGRAPHIC AND GEOLOGIC FEATURES OF THE ROSE HILL SITE.

The mass of steatite exposed on this site, being firmer and tougher than the gneisses with which it is associated, gave rise to a very decided prominence, now separated into two hills by a sharp ravine cut by the stream. The natural exposures are confined to the bed and the steeper banks of the stream and to the crests of the hills, which rise in somewhat conical form—the one on the south side to about 80 feet and the one on the north side to upwards of 90 feet above the stream.

The northern hill has a rounded, somewhat oblong summit, on which the steatite is exposed or approaches very near the surface for a length, nearly north and south, of upwards of 100, and a width of twenty or thirty feet. The rock seems to be bedded with the greatest length of the crest and consists of nearly vertical, more or less massive, layers of steatite. The slopes of the hill are covered with deposits of clay and vegetable mold, and consequently the formations with which the steatite is surrounded and interbedded are in no place visible. The whole site is thickly covered with forest trees and underbrush.

* E. R. Reynolds, Thirteenth Annual Report of the Peabody Museum, p. 526.

† Louis A. Kengla, Archæology of the District of Columbia, Washington, 1883.

SURFACE INDICATIONS OF THE ANCIENT QUARRIES.

The evidences of ancient pitting are confined chiefly to the summits of the hills, but no one can say to what extent the exposures of soapstone in the sides of the ravine were worked. The south bank of the stream has recently been worked to a considerable depth by the whites, and the original configuration is destroyed, but on the north side there is an obscure but still traceable excavation of very considerable dimensions that may be at least partially due to aboriginal hands.

Pits sunk in the side of the hills would soon be obliterated by débris descending from above, but upon the crests they would necessarily remain clearly marked for a long period of time, as their obliteration would depend upon the very slow accumulations of vegetable mold. In any attempt at estimating age, therefore, the relation of the excavations to the surrounding surface must be considered with care; this has already been pointed out in connection with the quartzite bowlder quarries.

My work has been confined exclusively to the summit of the northern hill, as the ancient quarries there appear to have remained wholly undisturbed, save by the normal agencies of nature. A row of pits, forming almost a connected trench, extended along the crest and for a short distance down the north end of the hill. There were five well-marked depressions in this series. The outlines were irregular. The greatest diameter was perhaps 25 feet and the greatest depth, save where measured between the lateral ridges of débris, was not above two feet. Dr. Reynolds mentions one pit upon the southern hill as being over three feet deep. The heaps and ridges of débris thrown from the pits by the ancient miners extended along the sides of the row of pits and were hardly above a foot in height. This débris consisted for the most part of earth and irregular fragments of steatite. Among the latter were many worked pieces—fragments of unfinished vessels and rejects of all kinds.

Shallow depressions marking the sites of ancient pits occur along the sides of the crest on the south and west sides of the hill.

EXCAVATIONS.

Operations were commenced by carrying a trench across the southern pit, which occupies the highest point of the hill. This

exposed the ancient quarry face on the south, east, and west sides, while the north edge of the excavation penetrated the full depth of the ancient quarry, which was here about four feet deep.

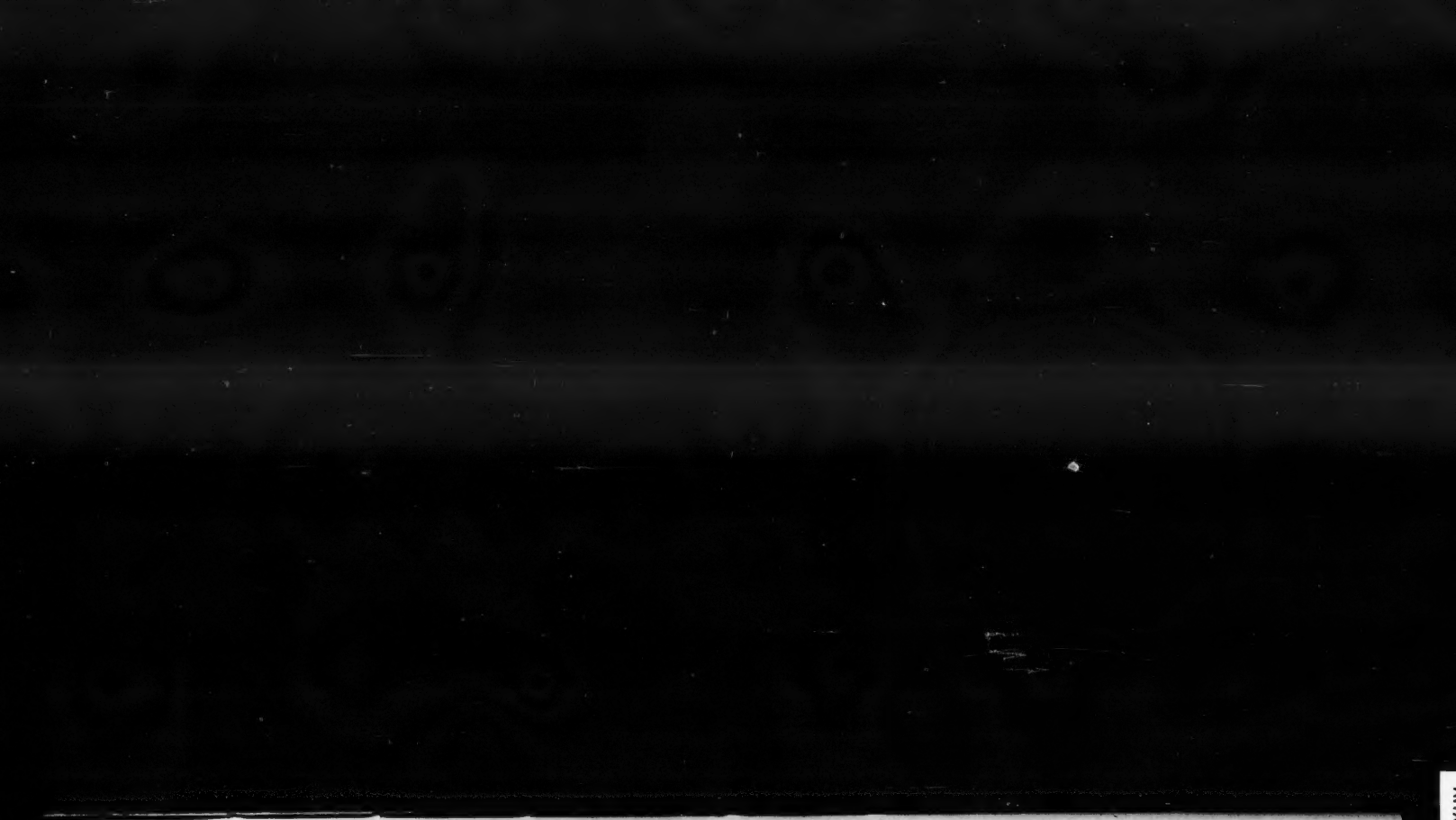
Beginning with the deepest part of this first trench, a wide trench was carried north along the chain of ancient pits. Cross-trenches were dug at frequent intervals and others were subsequently dug on the south slope. In all about 500 square feet of the ancient quarry floors were exposed and cleared off, and a very good idea of the nature of the ancient quarrying was thus obtained. The principal pits were worked to a depth of from two to four or five feet by the aborigines, and the bottoms and sides present the irregular appearance necessarily produced by prying out such masses of potstone as the quarrymen were able to detach.

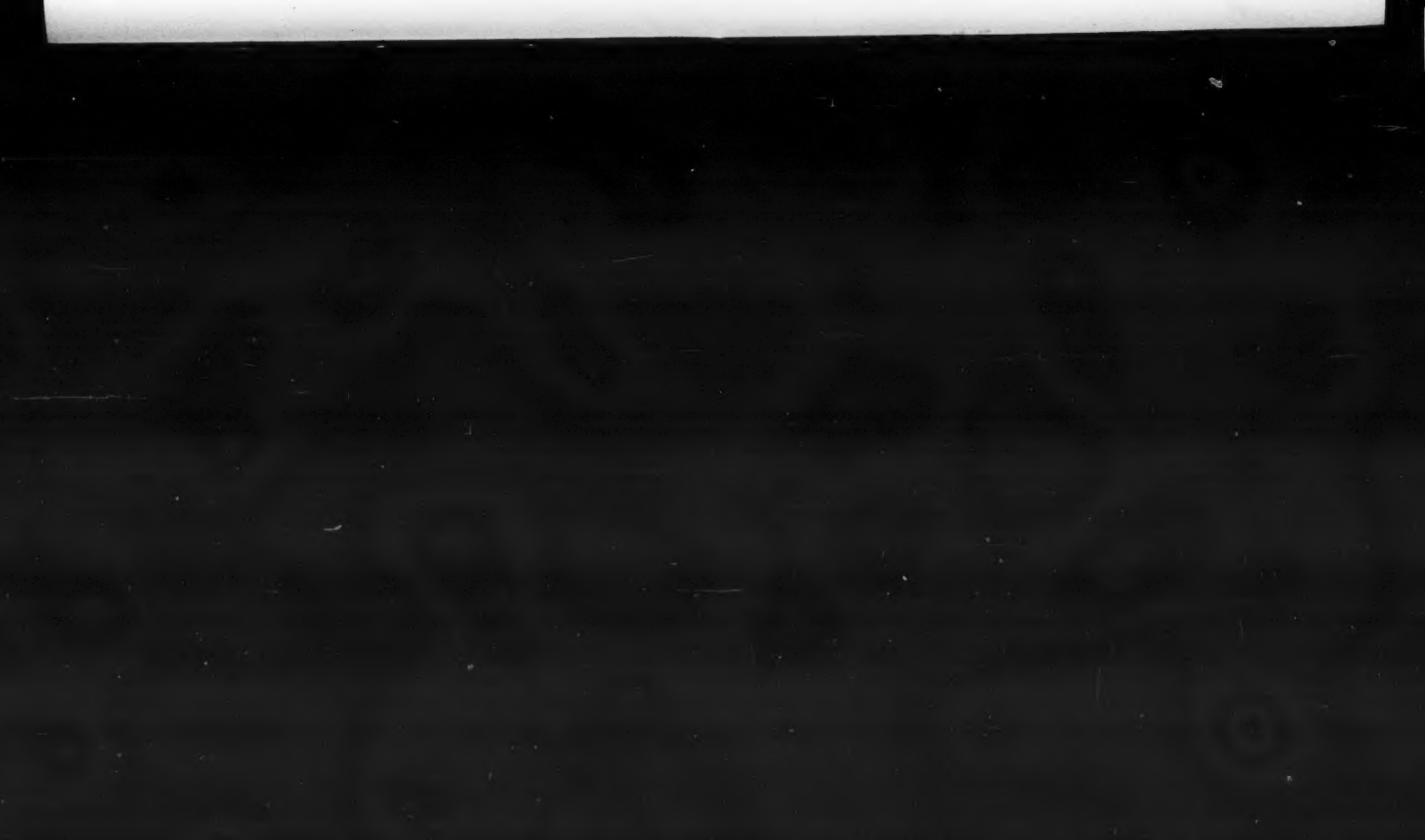
IMPLEMENTS USED IN QUARRYING.

As with the quartzite bowlder quarries, little could be learned of the methods of quarrying. Perhaps wooden, horn, or bone tools were used to loosen and remove the earth and, with the assistance of hafted stone implements, to detach and break up the rock. There is no indication that the potstone was detached by cutting or picking with pointed tools. The exposed surface seems for the most part to represent cleavage planes.

SHAPING OF VESSELS.

These ancient quarries were worked exclusively for the purpose of securing material to be used in vessel-making. The pots were not shaped in place to be detached by under-cutting after the roughing out was accomplished, as observed by Schumacher in California. It would appear that these vessels were usually too wide to permit of this method of working and detachment. No tool in the possession of our eastern aborigines would have been equal to such an undertaking save by immense expenditure of labor; beside, there was too much uncertainty as to the cleavage and fracture of the stone to waste time in shaping before thorough testing by removal. The block was first secured, then trimmed down to the approximate size and form, and then hollowed out ready for the finish, which was in most cases accomplished elsewhere. Even with this method there were naturally many failures from breaking, from splitting along partially developed cleavage planes, and from imperfections in tex-





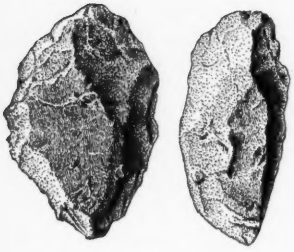


Fig. 1.

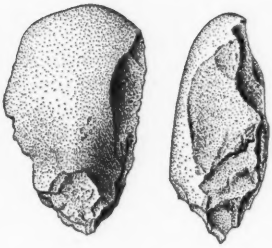


Fig. 2.

Fig. 3.

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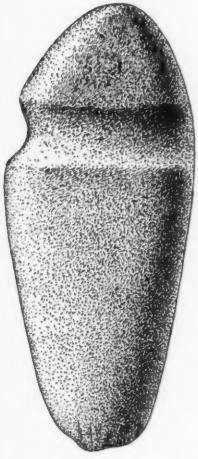


Fig. 6.

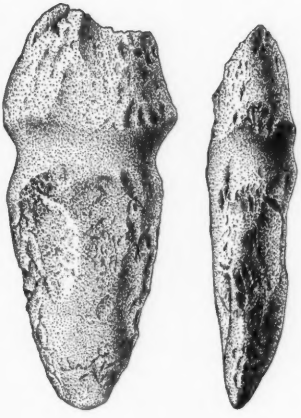


Fig. 7.

Implements used in quarrying and cutting Soapstone, ¼ actual size.

ture. It is safe to say that many hundreds of these failures yet remain upon this site, in the pits, in the piles of débris, and scattered far down the slopes and along the stream beds.

On account of the rude state of the rejects left upon the quarry site we cannot in all cases determine the precise character of the vessel intended. The whole range of steatite utensils employed by the Algonkian people are probably represented. A prevailing form is the oblong basin having ear-like projections or handles at the ends. These incipient vessels are usually shallow. The largest specimens are about 25 inches in length. The width is not more than half the length and the depth averages perhaps one-half the width. The rejects are very often unsymmetric and extremely rude. Other forms, approaching more nearly a circular outline and usually having greater depth, are common. Roughed out cups of small size are found in considerable numbers. Handles vary much in size, shape, and position.

The shop refuse contains illustrations of manufacture beginning with specimens rejected almost with the first stroke of the shaping process and ending with vessels so nearly complete as to have been fitted for use. The best, however, still lack the finishing touches observed in specimens found on village sites. The first step was naturally that of testing and reducing the shapeless mass to a rude approximation of the proportions of the vessel to be made. A favorable side for the top was chosen and the excavation began, perhaps by pick strokes outlining the basin, perhaps in cases by working from the center out toward the rim; there was probably no uniform method of procedure.

Tool-marks are much obscured by weathering in specimens found upon the surface, but in those from a depth they are as fresh as if made but yesterday. The tool has in cases been pointed or spike-like, but generally had a rounded cutting edge half an inch or more in width. This edge was, as a rule, rather rough and uneven, as if of chipped rather than of polished stone. The character of the strokes vary a great deal; in some cases they are bold and professional in appearance and in others timid and irregular.

There are three ways in which the aboriginal tools could have been used. The simplest is that of holding the heavy pointed stone in the hand or hands and thus striking the potstone. Much power is gained by hafting the tool and using it as an adz. The length, boldness, and irregularity of the marks upon the rough pots suggest

this method very strongly. Again, a chisel and mallet may have been used, after the fashion of the modern stone-cutter. The marks left by the latter process would assume a more regular arrangement than observed in the products of this quarry, and they would exhibit evidence of a succession of blows. There are no chisel-like tools that bear evidence of use under a hammer or mallet, and we know of nothing that could have served as a striking tool. I am inclined to favor the idea that a hafted tool was used in the roughing out. One grooved axe only was found, but the ancient quarries of Maryland furnish many examples of pick-like forms provided with grooves.

THE TOOLS RECOVERED.

The tools with which the work of quarrying was accomplished were sought most assiduously. Their character and their relations to implements found in other localities and applied to other uses are matters of no little interest to the archæologist. It was expected that they would, in a measure at least, correspond to the tools known to be used by the modern Indians, as many steatite pots are found upon ordinary village sites. It was to be expected, however, that tools used in such work would be especially adapted to it, which is unlike any other industry of the aborigines, and that they would be in a sense unique; but there were chances that implements of well-known forms were used and lost upon the site.

The remoteness of the site and the conformation of the hills upon which the quarries are located rendered it improbable that the locality was used for dwelling or for any other purpose than that of quarrying the potstone and roughing out the vessels. All tools found should, therefore, be quarry tools.

The absence of bowlder or other deposits of material habitually utilized by the aborigines gave additionl simplicity to the quarry art, rendering it reasonably certain that all articles found pertained to the soapstone work; that all save those of soapstone had been carried in by the quarrymen.

As in the case of the quartzite quarries, no tools were found that could have been used in excavating the pits and detaching the masses of steatite; all were adapted rather to the work of sculpture—to the roughing out and shaping of the vessels.

The tools found may be conveniently divided into two classes—those improvised upon the spot for special and temporary use, and those of standard varieties brought from the villages and utilized

temporarily in the quarries. A vast majority are of the former class. They are, as a rule, quite rude and were derived from the vicinity of the quarry. They approach more nearly a palæolithic type than any other forms found in the Potomac region. Nothing more primitive is found in America. The hills and slopes in the vicinity abound in outcrops of vein quartz which break up into angular fragments. These are now so plentiful upon the neighboring fields as to make agriculture a burden. Such angular fragments were gathered for use in the quarries; some were already well adapted to use, whilst others were trimmed to better points and edges (Fig. 1). Quartzite bowlders found sparingly upon the neighboring slopes were also worked into rude picks by flaking (Fig. 2).

A small number of angular masses of quartz were discovered that were not apparently adapted to any use and that showed no signs of having been used. They may be fragments of larger masses broken in use.

A few cobble-stones were found, but none showed very decided evidence of use as hammer stones, or otherwise.

It is not considered necessary to take further notice of specimens that do not show decided evidence of design or use, or that by their natural conformation seem to be especially well adapted to known uses.

The objects of quartz that show evidence of shaping by percussion are all of one type. They are thick angular masses weighing a pound or more; one end is brought to a short, sharp point, and the other is somewhat rounded as if to be held in the hand or hands for striking (Fig. 1). Of the same general shape are two picks made from quartzite bowlders and resembling heavy pointed "turtle-backs" (Fig. 2.) In no case does the form of these tools suggest the attachment of a haft, although such attachment would probably be feasible in their present state.

Two small chisel-like tools were found in the main trench on the summit of the hill. They are of unique types, and we may fairly assume that they were made for use in the potstone shop. One is made of a black slate-like rock that has become gray on the surface through oxidation of some of its constituent minerals. In its general configuration it is much like the quartzite blades produced in the quarry shops of the District, but it differs from them in having a chisel-like point or edge (Fig. 3). This edge is somewhat oblique and shows but little evidence of use, although it should be ob-

served that chemical changes in the stone would tend to obliterate such evidence.

Another specimen (Fig. 4) is of gray slate, very slightly altered by chemical changes. It is rather rudely chipped along both sides, and the point has been made quite sharp by grinding and subsequent use. Properly hafted this little celt would have been a very effective tool in shaping the half-finished vessels. As it stands it is rather small for convenient use. Possibly it may have been hafted after the manner of an ordinary stone knife. Tools of this class are abundant on the quarry sites of Maryland and Virginia. They reach nearly a foot in length, and in cases have a polished chisel-like point at each end.

From the soil that filled one of the shallow pits on the south margin of the crest of the hill, a chipped quartzite tool of unusual shape was obtained (Fig. 5). It resembles the borers or perforators of the same material found on village sites, but is ruder and less symmetrical and was probably made especially for use in the trimming of soapstone vessels.

One of the most important finds made during the excavation at this place was a large grooved axe of the wedge-hafted type (Fig. 6). It was found in one of the shallow pits on the south margin of the hill-top, one foot from the surface, and resting upon the surface of the soapstone in place. There can be little doubt that this tool was used by the ancient quarrymen in dislodging, and perhaps in trimming, the masses of stone. Its edge shows considerable wear, apparently from use as a pick. Its weight and shape would make it a very effective tool. If proof were necessary that the workers of these quarries were Indians, the discovery of this object would seem to be satisfactory. Surface finds upon the sites of ancient soapstone quarries in Maryland include many of these grooved axes. In most cases they have been remodeled by flaking to fit them more perfectly for use as picks (Fig. F).

CONCLUSION.

The question in this connection that claims first attention is what correlations can be made between the soapstone quarries and the quartzite bowlder quarries of the District. Are they all probably of one age and the work of one people, or are they separated by long periods of time and by marked differences in art characters?

It may be first observed that the two classes of quarries are located in the same valley and only one and one-half miles apart; that

they correspond as closely in extent of work and in appearances as could be expected if worked at one time and by one people. There are striking dissimilarities, but these are due to differences in the nature of the materials quarried and the relation of the quarries to adjoining formations.

It appears that the soapstone was not quarried to a depth equal to that of the quartzite bowlders, but it will be seen at a glance that the difficulties attending the working of the former are much the greater. With increasing depth the soapstone becomes firmer and more massive, and it is impossible with primitive tools to detach the necessary masses. The shafts must therefore necessarily be shallow With the bowlders the difficulty does not increase with the depth in the same degree, and greater depths could be reached with comparative ease.

Again, it must be admitted that the bowlder quarries exhibit more decided evidence of great age than do the soapstone quarries. In the former the pits are much more completely filled up and obliterated. This fact may, however, tend to lead to erroneous conclusions if the conditions under which the two classes of pits existed are not considered.

The deepest soapstone pits were not over four or five feet deep, but they were excavated in solid rock and upon the crests of hills, where there was absolutely no material to fall into them save the leaves from the trees. Such ancient pits as were not upon the summits were entirely or almost entirely filled up.

The cobble pits on Piny Branch were in all cases situated upon the slope of the hills, and were therefore directly beneath overhanging masses of loosely compacted sands and gravels and may have been more completely filled up in one year than the soapstone pits in a century.

On the other cobble quarry site, near the new observatory, some of the pits situated upon the hill-top and originally eight feet deep were not more than ten inches deep when first examined by us, but when we observe that the walls of these pits were composed of coarse loose gravel capped with sandy clay we must conclude that the chances are that they would be obliterated very much more rapidly than if the walls consisted of tough massive stone.

The character of the two sites corresponds very closely in this, that both are in the hills and so steep as to be quite unsuited for camping or dwelling. Both are therefore naturally free from village

refuse, and the tools found must for the most part, if not exclusively, consist of those actually used in the work of quarrying and roughing out the implements produced. In neither case has any tool been found that is not germane to the work of the quarries, and this correspondence is most significant, as archæologists will readily apprehend.

In the cobble quarries no tools of a durable material were needed save those found by thousands in the quarries. Carefully shaped hammer stones, polished celts, and grooved axes had no place in these quarries; no more place, as I have shown, had the finished tools of the classes here roughed out. A grooved axe, such as that found in the soapstone quarry, would be an effective tool in the work of quarrying soapstone, and it could be used without the least danger of breaking it. The chisels also are of types that resemble ordinary Indian work, but they also were especially adapted to, and no doubt especially made for, the quarrying of soapstone.

The only tools, then, that correlate the workers of these soapstone quarries with the Indian were not carried in aimlessly and lost, but were lost because there in use. It will not, therefore, be safe to say that because no traces of ordinary Indian tools were found in the bowlder quarries the workers in these quarries were not Indians, for I have amply shown that such tools could not have been used, and hence they would stand small chance of being lost there. It may be emphatically stated that in none of the quarries has any trace of art been found that did not pertain directly to the work of the quarry.

If the correlation of the Indian with the workers in the soapstone quarries was necessarily dependent upon the loss of articles not germane to the work of the quarry, no such correlation could be made by any known evidence.

The nature of the work of shaping done in both classes of quarries has a close and significant correspondence. No single finished piece of work was found in either case. In the cobble quarries the blade was roughed out to a convenient shape for transportation and subsequent finish. In the soapstone quarries the pots were roughed out and carried away to be finished elsewhere. It is significant also that on many village sites in the vicinity quarry products of both materials are found freely and intimately associated.

A review, therefore, of the evidence shows many significant correspondences in the work of the two classes of quarries and no disagreements that require the assumption of wide differences in time, people, or culture.

WRITING MATERIALS AND BOOKS AMONG THE ANCIENT ROMANS.

BY A. P. MONTAGUE.

The subject may be logically divided into the following heads:

I. The materials used as paper.
II. The ink.
III. The pen or pencil.
IV. Books.

I. THE MATERIALS used as paper or in the place of paper were—

(1). The thin rind of the Egyptian papyrus.

(2). Parchment made of skins.

(3). Wooden tablets covered with wax.

(1). In the most common use, especially in the writing of books, was the thin coat or rind (*liber;* whence the Latin word for "book") of the Egyptian papyrus. The Egyptian name of the plant from which the rind was taken was *Byblos* (Greek βύβλος; whence βυβλίον, βιβλίον, "book").

This papyrus plant or tree, found in swamps in many tropical countries, and especially in the valley of the Nile, grows to the height of ten or twelve feet. We learn (Plin., *Nat. Hist.*, XIII., 23) that different pieces of the rind, having been wetted in the water of the Nile, which, according to eminent authorities, has a glutinous property, were joined together; a layer of these pieces was placed flat on a board and a cross layer put over it; these were pressed together and afterwards exposed to the sun to be dried. These individual sheets were from 8 to 14 inches high and from 3 to 12 inches wide. At one time the ancients wrote upon these sheets and then pasted them together at the sides in regular order; but in Pliny's time (A. D. 23–79) rolls of sheets pasted together ready for the writer were sold. In writing books an author could continue this pasting process until he made a book which occupied sheets stretching, when laid out, at least fifty yards, and there are Egyptian papyri rolls presented which are actually of this length. Dr. O. T. Mason of the U. S. National Museum informs the writer that he saw recently at Leyden

a roll of papyrus sheets fifty yards in length. But Roman authors usually divided a long work into several rolls, as a large book, if written on one-roll, would have required pasted sheets extending 90 yards or more. Callimachus, the poet and librarian of 250 B. C., said *μέγα βιβλίον μέγα κακόν*, "a large book, a large nuisance." When the writing was finished and the sheets had been pasted, a stick was fastened to the last sheet and all the sheets were rolled into what was termed a *volumen* (*volvo, volvĕre*, "to roll up;" compare the Eng. *volume*). This roll made a cylinder, and the top and bottom were generally stained black. To the ends of the stick, called *umbilici*, were added knobs, *cornua*, which were highly ornamented. It should also be noted that the ends of the sheets were carefully trimmed and polished with pumice stone. The title of the book was written in red color on a piece of papyrus or parchment (*titulus* or *index*) which was attached to the *volumen*. It was the custom to then steep the roll in cedar-oil (*cedrus*) and to place it in a parchment case stained purple or yellow. The poet Martial (40–102 A. D.) calls this dress in which the book was covered "a purple toga" (*purpurĕa toga*,—Mart., X, 93). Seneca (*De Tranq. Animi*, 9) and Martial (XIV., 186) inform us that the portrait of the author was often placed on the first page of the book. The ancient reader held the roll or book in his right hand, using his left hand to unwind as he read and to re-roll the part finished. Books were often kept in boxes called *capsæ*, generally cylindrical in shape, made usually of beech-wood. There were also *scrinia*, "chests" or "boxes," in which books, letters, papers, etc., were kept.

Long before the time of Herodotus (B. C. 484), as we learn from that author himself (V., 58), the Egyptian papyrus was known to the commercial world. He wrote as follows: "Moreover, the Ionians, from ancient time, call books made (even) from papyrus parchments, because formerly, from the scarcity of papyrus, they used the skins of goats and sheep; and even at the present day many of the barbarians write on such skins."

That papyrus was widely used in the western part of Europe we know, not only from reference in Latin authors but from the fact that many rolls of papyri were found at Herculaneum, and that paintings of them were discovered at Pompeii. Prof. Gow, an eminent Cambridge scholar, states that a few fragments of Homer, Thucydides, Euripides, and Sallust are extant on broken papyrus leaves or sheets.

The paper (*charta*) made from the papyrus was of different grades or qualities. The finest was called after the Emperor Augustus, the second grade after his wife Livia, the third was termed Hieratica (Ἱερατικός, "devoted to sacred purposes"), because it was used in sacred writings, originally in those of Egyptian priests. As the manufacturers or the dealers were politic men, and believed in making their positions strong with the powers that were, we hear later on that the best paper was called after Claudius, the Emperor. One kind, called *Emporetica* (ἐμπόριος, *belonging to commerce* or *merchants*), not being suitable for writing paper, was used by merchants to wrap parcels.

(2). Parchment made of skins.

Parchment (*membrana*) is said by some writers to have been invented by Eumenes II. (B. C. 263), King of Pergamus, a city of Mysia, now *Bergamo*, but this is clearly an error, because more than two centuries before Herodotus alluded, as we have seen, to skins as in use before his time and common in his day. Eumenes II. undoubtedly introduced some improvements in preparing skins for writing purposes while he was engaged in collecting and maintaining his great library of 200,000 volumes, afterwards given by Antony to Cleopatra and carried to Alexandria to form a part of the wonderful library there. The word parchment is derived from *Pergamēna*, "belonging to Pergamus," as at that city sheep skin and goat skin had probably their first distinctive use as materials in writing books. Eumenes was led, it is related (Plin., *Nat. Hist.*, *XIII*, 21), to use and improve skins as paper by the fact that Ptolemy Epiphānes, King of Egypt, fearing that Pergamus would rival Alexandria as the book centre of the world, had forbidden the export of papyrus. Parchment and papyrus sheets seem to have been almost the only materials upon which *books* were written among the Romans, the former coming into use for books (having previously been used for note-books) about 90, A. D., and gradually taking the place of papyrus. Prof. Lewis Evans, of Oxford, the scholarly translator of the satires of Juvenal, Persius, and Lucilius, says: "The manufacturer of parchment was termed *Membranarius*. The parchment, after being rendered smooth by rubbing with pumice, was flattened with lead; and it was capable of being made so thin that the whole of the 'Iliad' written on this material, was inclosed within a walnut-shell!" Quintilian (X., 3) writes: "For persons of weak sight parchment is much better (than waxen tablets); but the rapid flow of

thought is checked by the constant necessity for dipping the pen in ink. Parchment sheets were pasted together and rolled in the same manner as those made from the papyrus plant. Parchment possessed certain advantages over papyrus, in that it was thicker and writing could be placed on both sides, though, originally, the back of the parchment was not used and was stained a saffron color; it was more durable, as papyrus was apt to be broken; and the same piece could be used several times. This fact gave rise to the singular custom of erasing or washing out the writing on parchment and of using it as new material. Parchment thus washed was termed *palimpsestus* ("scraped again"), palimpsest. In reference to this custom Cicero (*Ad Fam.*, VII., 18, 2) writes his lawyer friend, Trebatius, as follows: "I commend your economy because you (wrote) on palimpsest; but I wonder what was on that little piece of paper which you were willing to destroy rather than not write this (letter; lit., *these things*) to me, unless (it was) perchance your own legal forms. I can't think that you are destroying my letters in order that you may put yours (on the paper)." In other words Cicero wondered what could be less important than a friendly letter.

Several remarkable facts are given by Dr. Gow in connection with this custom. The monks of the Middle Ages, in their desire to write the lives of their saints, washed and scraped old parchments which had fallen into their hands. Traces of original writing were long afterwards discerned under and between their lines, and, by the use of certain chemical preparations these first writings were brought out so that they were capable of being deciphered.

In 1816 Niebuhr came upon a MS. at Verona which contained certain writings of Jerome. Detecting marks of an older writing, he went to work and soon restored the ancient MS., which proved to be the famous legal treatise of Gaius, called "The Institutes," which had long been considered lost and had been for many years known only through references of other authors. Strange to say, about one-fourth of this entire MS. *had been scraped before*, and thus it was *doubly palimpsest.* (See Göschen, Report to the Academy of Berlin, Nov. 6th, 1817.)

The best MS. of Plautus was found at Milan underneath portions of the Old Testament; a part of Livy was found to be covered with the "Moralia" of Gregory the Great. Late Greek MSS. of classical authors have been found covering portions of the Bible. A MS. of Sophocles, copied in 1298, overlay an uncial MS. of the Septuagint. This MS. is now preserved at Florence.

Parchment leaves were often bound together and sewed at the back into a binding in the modern way. Such a book was at one time called *codex* or *caudex*, although this word had earlier and later meanings, which will be given.

As guides to the writer's pen, lines were drawn with lead on the parchment and these left faint impressions.

(3). Wooden Tablets covered with wax. The word *tabulæ* means properly "planks" or "boards," then gaming-tables, pictures, etc.; but its most general meaning in ancient Rome was *tablets used for writing*. It referred to tablets of any kind, stone, metal, or wood, nearly always the last. These *tabulæ*, in this sense, were pieces of wood, generally beech or fir, sometimes citron-wood (even ivory was used occasionally), covered with wax, in shape oblong. The outer sides of these tablets were of wood, only the inner sides being covered with wax. The two pieces of wood were fastened at the back with wires as hinges and could be opened and shut like our books. To prevent the wax of one tablet from rubbing against that of the other there was a raised margin around each.

Certain tablets called *pugillares*, from *pugillus*, "a handful," were very small and took their name from the fact that they could be held in the hand. Pliny the Younger in a letter (I. 6) to the historian Tacitus writes that he went on a wild-boar hunt, but that he took no spear or lance, only the hunting-nets and his pencil and hand-tablets, on which he diligently wrote while waiting for the boar to run into his nets. He urges the great historian to take along on his hunting expeditions a bread-basket and a little bottle, and not to forget the note-books, assuring him that he will find that Minerva keeps Diana company in the forests and mountains. These waxen tablets were used for almost any purpose when great length was not desired. Their chief use was in correspondence. When the writer had completed a letter, he bound the tablets together with a strong thread, which he tied in a flat knot, upon which he placed wax and then stamped this with the device on his signet-ring (*signum*). When letters were written by secretaries—the usual way—this was the only signature.

As is seen in an ancient painting of Love (*Amor*) giving a letter to Polyphemus, love-letters, called *vitelliani*, were written on tiny tablets (Martial, XIV. 8). Waxen tablets were also used in writing wills and other legal documents, and, when so used, the outer edges were pierced with holes, through which a triple thread was passed,

upon which a seal was put. This was done to guard against forgery, and any legal paper, especially a will, not thus secured was worthless. Among the many other uses of these tablets may be mentioned that of keeping accounts of sums received and disbursed. The term *codex* (or *caudex*) was applied to these tablets when bound together. In Cicero's time this name was also given to a tablet on which was written a bill to be offered to a voting body. Under the Emperors *codex* was used for any collection of laws (Cf. Eng. *code*), as the *Codex Justinianēus*.

There is an interesting account of two ancient waxen tablets in an excellent state of preservation found in gold mines in and near the village of Abrudbányá, in Transylvania. These *tabulæ* consist of three tablets each. One is of fir-wood, the other of beech-wood, each about the size of a small octavo. The outer parts are of plain wood; the inner are covered with wax, now grown almost black, and have raised margins. The middle tablet, also with raised margins, is covered with wax *on both sides*. The edges are pierced for the thread. On one of these tablets are some Greek letters, followed by certain unknown characters. The other tablet contains writing in Latin, which refers to some business connected with a *collegium* ("body" or "corporation"). The date, given by consuls, is 169 A. D. It is written *from right to left*, the writing beginning on what we would call the 4th page and ending at the bottom of the 3d. These waxen tablets had, in addition to the name *tabulæ*, the appellation of *cēræ*, and the pages were called *prima cera, secunda cera*, etc., "1st page" (or "leaf"), "2d page," etc.

Waxen tablets were used in Europe in the Middle Ages. The oldest of these mediæval tablets, of which we know, belongs to the year 1301 A. D. It is now in the Florentine Museum.

It may be added that some late MSS., mostly in Greek, are written on paper, a Chinese invention, brought to Europe by the Arabs of Spain. Paper made of cotton was called *bombycina*; linen paper, *charta* (Gow).

II.—THE INK.

The first mention of *Ink* among the Romans is made by Plautus (254–184 B. C.) in his play called "The Ghost" (*Mostellaria*, Act I., sc. III., 102), where he has an ironical reference to the attempt to make ivory white *with ink*. The next author who mentions ink is Cicero (106–43 B. C.), who, in a letter to his brother (*Ad Quint.*

Fr., II., 15) says: "The matter will be discussed with a good pen, well-prepared ink, and smooth paper. * * * I am in the habit of using whatever pen comes into my hand, as if it were a good one." An eminent scholar of Cambridge, England, whose researches have been careful and valuable, informs us that the ink used in writing on papyrus was made of lamp-black and gum, and that for parchment of gum and oak-galls. Pliny writes of the making of ink in his time as follows: "It is made of soot in various ways with burned resin or pitch; for this purpose they have built furnaces that do not permit the escape of smoke."

He also states that a kind of ink was made by boiling and straining the dregs of wine. This author further states that mice were kept from manuscripts if they were written with ink with which wormwood had been mixed. There can be no question as to the excellence of the ink used among ancient nations, when we read in the report of the British Museum on Egyptian Antiquities (Vol. II., p. 267) the statement that the color and brightness of Egyptian ink remain to this day, as is attested by certain specimens of their papyri, and when we recall the fact that at Herculaneum was found an inkstand containing ink which had become as thick as oil, but which could be used at the time of discovery (Winckelmann, Vol. II., p. 127).

The satirist Persius (III., 13 *et seq.*), writing of the troubles of a teacher with his pupil, says: "Now his book and the two-colored parchment cleared of hair, and paper and the knotty reed are taken into his hands. Then he complains that the ink, grown thick, clogs in his pen; then that the black *ink* disappears altogether if water is poured into it; then that the reed makes blots with the drops being diluted." From this quotation we learn two facts: that the Romans cleared and thinned their ink by pouring in water, and that the black matter emitted by the cuttle-fish, called *sepia*, was sometimes used as ink (Leverett's *Juvenal* and *Persius*, p. 239; Cicero, *De Nat. Deorum*, II., 50). The ancient Romans had, in addition to black ink, red ink made of *minium* or red lead, a pigment consisting of two atoms of the protoxide of lead and the peroxide, which was used in writing the titles and beginnings of books. Ink made of rubrīca ("red ochre," hematite) was also used for these purposes, and in post-Augustan times, as this rubrīca ink was used in writing the headings of laws, the law itself was termed *rubrica*, "rubric" (Quint., XII., 3). Roman Emperors and their near relatives wrote

their signatures with an expensive red ink which the law forbade others to use. If the Emperor was under age his guardian wrote with green ink. Dion Cassius tells us that Crassus, in his ill-starred expedition against the Parthians, had his banners marked with letters of purple ink. Cicero in his fourth Verrian oration and Suetonius in his "Life of Augustus" inform us that letters of gold and silver, or, more probably, letters covered with gilt and silver, were placed on pillars and monuments. Suetonius in the "Life of Nero" mentions the fact that one part of the poems which Nero recited at Rome was written in gilt letters. The Romans had also an invisible or *sympathetic* ink, which could be brought out only by heat or by the application of some chemical preparation. Ovid (*Art. Am.*, III., 627 *et seq.*) said that lovers might use fresh milk as their ink; that this would be invisible until brought out by the sprinkling of coal-dust. Pliny says that the milky sap of certain plants may be used in the same way. From the specimens found at Pompeii we know the shape and appearance of the ancient ink-stand (*atramentarium*). These specimens are both single and double, one well for black ink and the other for ink of some other color, probably red. In shape they are round or hexagonal. They have covers to keep out dust.

III.—THE PEN OR PENCIL.

Cicero in a letter to Atticus (VI., 8) and Horace in the 447th line of his "Ars Poetica" refer to the pen which the Romans used with papyrus and parchment. It was termed *calamus* (*Κάλαμος*) and was, as Dr. Gow says, of the same form as our old-fashioned quill pen. We learn from Pliny (*Nat. Hist.*, XVI., 36, 64) and Ausonius that the best reeds from which these pens were made came from Egypt and Gnidus, a Doric city of Cāria. When the pen became blunt it was sharpened with a knife made especially for this purpose, called *scalprum librarium*. The pen was split like our pens, and hence the name *calamus fissipēs*, "cloven-footed pen" or "reed" (Ausonius, VII., 49). This reed is even now, Professor Evans says, used as a pen in the East. For use with waxen tablets the Romans had an iron instrument called *stilus* (*γραφίον*), sharpened at one end for scratching on the wax, flat and circular at the other end for erasing, when it was desired, what had been written. Ovid and Suetonius tell us that this *stilus* was called *graphium* (Greek *γραφίον*) and from Martial (XIV., 21) we learn that it was placed, when not in use, in a case called *graphiarium*.

IV.—BOOKS.

From the time of Cicero there was a regular trade in books. Dr. Gow is the authority for the statement that the publisher either paid the author a royalty on each copy sold or gave him a fixed sum for the book. When a book was likely to be in demand, the author's copy was dictated to a large number of copyists (*librarii*) at once, 1000 copies sometimes being made. These copyists were slaves and often foreigners; hence many mistakes were made which sorely tried the patience of the author. Cicero, Strabo, Martial, and others complain of these blunders. The author himself often revised copies made by scribes, especially when he desired to present his books to friends. Booksellers (*bibliopōlæ*) had stores in many parts of Rome, but especially in a section called Argiletum (Harpers' Lat. Dict.). They advertised their books by placing lists of them at their doors. Among the famous booksellers were the Sosii in Horace's time and Tryphon in the time of Quintilian and Martial. The prices of books, of course, varied; some could be bought for one *denarius* (20 cents) apiece; others, according to popularity, size, or other varying conditions, especially the conscience or lack of this element on the part of the seller, were sold at five *denarii* (one dollar), or for a larger sum.

People too poor to buy books were not deprived of the privilege of reading them, as Rome had many public libraries. From the beginning of the reign of Augustus to the end of that of Hadrian, twenty-nine libraries for the people were founded. The first public library was instituted in the time of Augustus, by Asinius Pollio, consul, man of letters, and patron of literature, who not only established this library but also collected for the public eye many famous statues by Praxĭtĕles and other masters. Virgil in his fourth Eclogue and Horace in many places testify their regard for this eminent man who did so much for men of genius and for any workers in literature who sought and deserved his aid. It was Pollio who instituted the custom of an author reading his productions to learned and accomplished men, invited to meet him with a view to hear and to criticise, but, according to the author's wish, to do as little of the latter as possible, if the criticisms were not to be laudatory. This custom at last became a farce and, worse still, a bore, to everybody. Juvenile, in his famous first Satire, lashes with unsparing hand the miserable so-called poets who drove him to write

satire by their public and private recitals. Private individuals collected books, and certain private libraries, as those of Cicero and Atticus, who is represented by Cicero as sitting in his cosey library under the bust of Aristotle, were the most attractive portions of their palatial homes. Libraries, both public and private, were adorned with portraits and busts of eminent men and with statues and statuettes of Minerva and the Muses. A library entirely furnished was found at Herculaneum. It was a small room, so small that a person standing in the middle of it could touch both sides.

As the works of certain Roman authors were used in schools as text-books, many editions were written. In Juvenal's time the works of Horace and Virgil and a part of Livy were favorite school books. As certain authors did not take with the public or with teachers, their works were not re-written, and thus their productions fell out of use and out of sight forever.

THE INHABITANTS OF THE BISMARCK ARCHIPELAGO.—An article by Count Joachim Pfeil, entitled the "Land und Volk im Bismarck Archipel," recently published in the "Verhandlungen" of the Berlin Geographical Society, contains many interesting observations on this comparatively little known race of cannibals. The name Bismarck Archipelago is a purely political designation applied to the group of Melanesian Islands under the German protectorate, including New Pomerania (New Britain), New Mecklenburg (New Ireland), New Hanover, Bougainville, Choiseul and Isabelle. The latter islands are really part of the Solomon Islands. The inhabitants of these islands belong to what is really one race, but show marked differences on the different islands.

For instance, the New Pomeranian is a big, powerful, muscular man, with very little of the grace so often characteristic of black races. His complexion is that of a light negro, with an admixture of somewhat more red. His hair is curly, his mouth coarse and wide, his nose flat, and his countenance almost expressionless. The New Mecklenburger, on the other hand, though of about the same complexion, is of slighter and more elegant build, his features are far more pronounced, and his expression is wide awake and crafty.

Among other interesting things the article contains detailed descriptions of several festivals and several interesting tales.

INDIAN ORIGIN OF MAPLE SUGAR.

BY H. W. HENSHAW.

For a long time it was a popular idea that the Indian was a savage with all the traits that pertain to savagery, and with few or none of the instincts that are supposed to inhere in civilized man. This supposition has gradually given way to a clearer apprehension of the status of the Indian, as his achievements in one direction and another have been recognized and studied. Far from being a wandering savage dependent solely upon his skill as a hunter and fisher, it has been ascertained that over nearly all the United States he was practically sedentary, and that east of the Mississippi all the tribes, and not a few west of that river, depended for a livelihood more upon the results of agriculture than upon any other one source. Moreover, the agriculture practiced by the Indian has had tremendous and far-reaching consequences to civilized man. For the most important product of the Indian's tillage was maize, and while we may be in some doubt as to the exact region in which maize originated and probably shall never know the tribe or family which first cultivated it, there is no ground to question the fact that it was discovered by the Indians in its wild state, its value as a food ascertained by him, and by him it was cultivated for so long a period that it has become so changed as possibly to defy identification in its wild state, if, indeed, it still exists in a state of nature. Taken from the Indian's hand, it has been fostered by a more skillful culture till it has become one of the most important of food plants and helps to sustain millions of human beings in every grade of culture the world over.

Though the most important gift of the Indian to civilization, maize is not his only one. Pumpkins, beans, one of the most valuable cotton plants, and tobacco, the latter of which has enslaved man to the uttermost parts of the earth, are also gifts from the Indian to his conqueror.

It might not be very easy to point out just what benefits the Indian has received from his civilized brother in return for the above and other gifts. Perhaps, if he has received little the fault may not be

entirely that of his civilized brother, though there are philanthropists who appear to think so. However, it is not the purpose of the present paper to discuss the Indian's success or failure in adjusting himself to the requirements of advanced civilization, but to present some evidence tending to show that there is still another important product for which civilized man is indebted to the Indian.

Allusion is made to Maple Sugar, the origin of the manufacture of which appears to be in doubt in the minds of some.

During the last census year (1880) more than thirty-six millions of pounds of maple sugar were produced in the United States, and more than a million gallons of maple molasses, which together had a value of perhaps $4,000,000.

These figures show that the maple sugar industry is a by no means contemptible one, and, although for the practical purposes of to-day it matters not whether the art of its manufacture originated with the Indian or European, its origin is by no means unimportant to the student desirous of ascertaining Indian arts that he may have a clear idea of the position attained by the Indian race in its struggle upwards.

Considering the great familiarity of the Indians with the natural edible products of America, and the general ignorance of the European on this subject, it is fairly to be inferred that the *a priori* likelihood of the discovery of the properties of the maple sap is all in favor of the Indian. If maple-sugar-making in the Northern United States preceded the arrival of the European and if the latter derived the art from the Indians, it is reasonable to expect to find statements to this effect in the early French narratives. On the other hand, it is to be said that if the discovery of the saccharine juice of the maple and the simple art of boiling it down to sugar were made by Europeans, is is even more probable that this fact would have been duly recorded by the early chroniclers. I am not prepared to say whether the earliest chronicles, say 1600–1675, contain information as to the Indian or European discovery of maple-sugar-making. If the matter is not referred to, its absence cannot be taken as conclusive either as to aboriginal or European origin. Many customs of the Indians far more important than this received but the briefest mention by the early narrators or are not mentioned at all.

Most of the notes presented herewith were collected years ago in connection with the general subject of Indian food, and, although it is not pretended that they are exhaustive, they seem sufficient to

indicate pretty clearly that maple-sugar-making is an aboriginal industry, and perhaps render reference to earlier authorities unnecessary.

The first reference which I happen to have occurs in Joutel's Journal, which is to be found in Margry Découvertes, III, 510. A very free translation of the same appears in French Hist. Coll. La., I, 216, 1846.

A fair translation of the passage is appended, although it throws no light upon the question of the origin of sugar-making:

"We had not much meat, but Providence furnished us a kind of manna to add to our Indian corn, which manna was of a juice which the trees eject in this season, and notably the maples, of which there are many in this province and which are very large. In reference to this we made large incisions in each tree, to which we applied a vessel and a knife below the incision to conduct the liquor, which properly is the sap of the tree, which, being boiled, as it diminishes becomes sugar. We used this water to boil our Indian corn or sagamite, which gave it a rather good taste—that is, a little sweetened. It seems that Providence provides for everything, for, as there are no sugar-canes in these provinces, the trees furnish the sugar; at least I have seen some which was excellent. It was more reddish than ours—that is, what is used in France—but nearly as good."

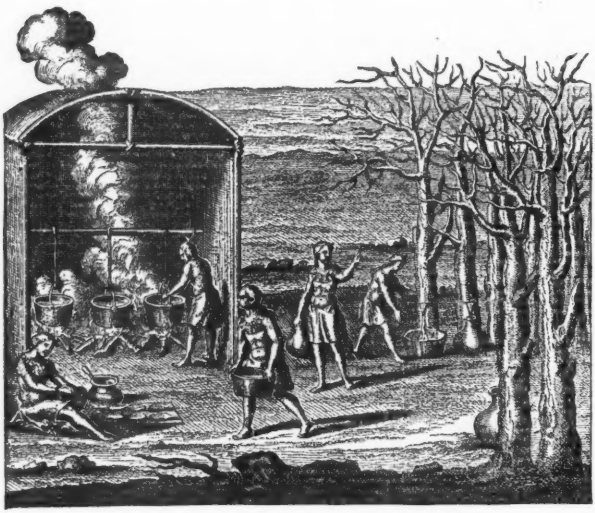
The next reference is to be found in Lafitau, Vol. II, 153, 1724, the period of the author's observation dating back to 1700–5. He says:

"In the month of March, when the sun has taken a little strength and as the trees enter into sap, they, the Indians, make with their hatchets transverse incisions in the trunk of the trees, from which trickles in abundance a water which they receive in large receptacles of bark. They afterwards cause this water to boil over the fire, which consumes all the watery matter, and which thickens the rest into the consistency of syrup, or even into cakes of sugar, according to the degree of heat to which they subject it. There is no further mystery to this. This sugar is a very good pectoral, and is admirable in remedies; but, although it is more healthy than that of the canes, it is not agreeable, nor has it delicacy, and nearly always has a burnt taste. The French make it better than the Indian women, *from whom they have learned how to make it;* but they have not yet been able to whiten or to refine it."

So far as Lafitau's knowledge goes, his statement of the derivation of the art from the Indians is direct, if not conclusive. He

says that the French learned it from the Indians. Upon just what evidence he makes the statement does not appear, but he was unusually well acquainted with aboriginal habits, and probably did not overlook the fact that in the 100 years of French contact preceding his own observation there was plenty of time for the French to have taught the art to the Indian. His statement of its aboriginal origin would seem to be entitled, therefore, to considerable weight.

A reproduction is here given of Lafitau's curious illustration of the Indian method of tapping the maple trees, collecting the sap, and boiling it down. For the kettles employed in boiling the sap the Indians are evidently indebted to the French trader; otherwise the process indicated appears to have been purely aboriginal.



Indian sugar-making. Reproduced from Lafitau.

Bossu, writing somewhat later, in 1756, is equally explicit as to the source of the art of sugar-making. He says (Travels through Louisiana, Vol. I, 188, 1771): "After the first ceremonies were over, they brought me a calabash full of the vegetable juice of the maple tree. The Indians extract it in January, making a hole at the bottom of it, and apply a little tube to that. At the first thaw

they get a little barrel full of this juice, which they boil to a syrup: and being boiled over again, it changes into a reddish sugar, looking like *Calabrian manna*. The apothecaries justly prefer it to the sugar which is made of sugar canes. The French who are settled at the *Illinois have learnt from the Indians to make this syrup*, which is an exceeding good remedy for colds, and rheumatisms."

Keating (Exp. to the Source of St. Peter's River, Lond., 1825, Vol. I, p. 114) also offers some satisfactory testimony from the Indian's side of the question. The quotation, though evidently a paraphrase of the language used by the Indian, is given in full, as it contains the Indian's method of sugar-making: "We are informed, that they profess to have been well acquainted with the art of making maple sugar previous to their intercourse with white men. Our interpreter states that having once expressed his doubts on the subject in the presence of José Renard, a Kickapoo chief, the latter answered him immediately, with a smile, * * * 'Wherefore should we not have known as well as they how to manufacture sugar? He has made us all, that we should enjoy life. He has placed before us all the requisites for the support of existence—fire, trees, &c. Wherefore then should he have withheld from us the art of excavating the trees in order to make troughs of them, of placing the sap in these, of heating the stones and throwing them into the sap so as to cause it to boil, and by this means reducing it into sugar?'" Keating adds: "In this reply of the Kickapoo we have a brief sketch of the rude process practised by the Indians in the preparation of the maple sugar. Previously to this they had learned the art of making and using pottery, but had abandoned it for the purpose, as Metea told us, of using wooden troughs, and hot stones; perhaps because their pottery did not stand fire well. The evaporation resulting from the action of the hot stones produced a crystallization of sugar in the trough. Their process was a tedious and imperfect one, which probably required much time before it could be improved." * * *

The Kickapoo themselves would thus seem to have believed that the art was wholly their own, or at least to have had no knowledge of its derivation from the European.

Moreover, the aboriginal method here indicated seems of itself to offer excellent evidence that sugar-making was an aboriginal art. Had it been known to the Indians through European instruction only, its manufacture would in all probability have been ac-

companied by the utensils of civilization. The method of boiling described above, viz., boiling in bark or wooden vessels by means of heated stones, seems to have been the usual one among the Indians, at least in the regions remote from civilization. It was, of course, at once superseded by the use of metal kettles where these could be obtained, since boiling the sap by means of heated stones must have been tedious and wasteful, and, as Keating remarks, the earthen vessels manufactured by the Indians were hardly capable of standing the necessary great and long-continued heat.

Allusions to the manufacture of sugar by the Indians are not uncommon in early colonial times, but most authors appear to have taken it for granted that it was an Indian art, and so have passed it by with a word. Col. Smith, in Drake's Ind. Captivity, 1850, alludes to it several times, and on page 197 gives the following interesting account of its manufacture and use by the Caughnawaga on the S. E. shore of Lake Erie: "In this month [February] we began to make sugar. As some of the elm bark will strip at this season, the squaws, after finding a tree that would do, cut it down, and with a crooked stick, broad and sharp at the end, took the bark off the tree and of this bark made vessels in a curious manner that would hold about two gallons each. They made above one hundred of these kind of vessels. In the sugar tree they cut a notch, sloping down, and at the end of the notch stuck in a tomahawk; in the place where they stuck the tomahawk they drove a long chip, in order to carry the water out from the tree, and under this they set their vessels to receive it. As sugar trees were plenty and large here, they seldom or never notched a tree that was not two or three feet or over. They also made bark vessels for carrying the water that would hold about four gallons each. They had two brass kettles that held about fifteen gallons each and other smaller kettles in which they boiled the water. But as they could not at times boil away the water as fast as it was collected they made vessels of bark that would hold about one hundred gallons each for retaining the water, and, though the sugar trees did not run every day, they had always a sufficient quantity of water to keep them boiling during the whole sugar season.

"The way we commonly used our sugar while encamped was by putting it in bear's fat until the fat was almost as sweet as the sugar itself, and in this we dipped our roasted venison." On p. 215 he adds one detail in respect to its manufacture which seems to me to

be peculiarly primitive. "We had no large kettles with us this year, and they made the frost, in some measure, supply the place of fire in making sugar. Their large bark vessels for holding the stock water they made broad and shallow, and as the weather is very cold, here it frequently freezes at night in sugar time, and the ice they break and cast out of the vessels. I asked them if they were not throwing away the sugar. They said no; it was water they were casting away. Sugar did not freeze and there was scarcely any in that ice."

The same method, however, seems to have been well known to the whites of later times, who employed it with success, and also the method by evaporation without the use of heat. (See Rush in Trans. Am. Phil. Soc., 69, 1793.)

In League of the Iroquois, p. 369, Morgan speaks of sugar-making and states: "Whether they learned the art from us or we received it from them is uncertain. One evidence, at least, of its antiquity among them is to be found in one of their ancient religious festivals, instituted to the maple and called the Maple Dance." The evidence here adduced in favor of its antiquity seems important, since it is not to be supposed that a festival would have been originated in honor of the maple unless the art of extracting its most important product had long been known. As will be noticed, the Ojibwa also had a maple-sugar festival, as probably also other tribes who manufactured it, and it is scarcely to be doubted that such tribes had also myths accounting for the origin of the maple tree and explaining the mythic means by which they became possessed of a knowledge of the properties of its sap and of the manufacture of the latter into sugar.

Maple sugar was, in truth, more than a mere luxury to the northern tribes, and Heny, in his Travels, 1760–1776 (p. 70, 1809), states: "Though, as I have said, we hunted and fished, yet sugar was our principal food during the whole month of April. I have known Indians [Ojibwa] to live wholly upon the same and become fat." Rush states that the Indians "mix a certain quantity of maple sugar with an equal quantity of corn dried and powdered in its milky state. This mixture is packed in little baskets, which are frequently wetted in travelling without injuring the sugar. A few spoonfuls of it mixed with half a pint of spring water afford them a pleasant and strengthening meal." (Trans. Am. Philos. Soc., 74, 1793.)

Maple sugar was, in fact, part of the annual supply of food, and the maple groves were regularly resorted to for its manufacture.

Though the above evidence, so far as it goes, seems to decidedly favor an aboriginal origin for maple-sugar-making, it appears to me of less consequence than certain linguistic testimony which may be cited. But first a word as to the range of the sugar-producing maples.

The sugar maple (*Acer saccharinum*), though flourishing best in a northern climate, yet possesses an extensive range in the United States, extending south along the Alleghanies to northern Alabama and west Florida, west to Minnesota, Nebraska, eastern Kansas, where rare, and eastern Texas. (For range of this and other species see Sargent, Vol. I, Tenth Census, 1884.) There are two other trees from which sugar is occasionally made, viz., the Silver Maple (*A. dasycarpum*) and the Box Elder (*Negundo aceroides*). I doubt not that the latter trees were tapped by the Indians for sugar, but I am unable to say positively that such was the case. If the range of the two latter species be taken into consideration, it is evident that one or more of the sugar-producing trees must have been known to all the tribes north of the Gulf States and as far west as the plains, and even in the Rocky Mountains. The manufacture of maple sugar, however, appears to have been chiefly limited to the northern tribes, especially to those of New England and the region of the Great Lakes, though the Indian languages quoted below show that the knowledge of the sap-producing properties of the tree, if not the knowledge of maple sugar, was by no means confined to these sections.

Certain it is that a knowledge of the sap-producing properties of the tree could not long have preceded the knowledge of maple sugar. The sap would naturally first be used as a beverage; but the discovery of the art of boiling it down could not have long been delayed, though the freezing process may have been first in order of time.

When European novelties were introduced among the Indians there were two methods of naming them. Frequently, as in the case of sugar below cited, they did their best to adopt the foreign name. This was particularly true in California, where Spanish names for almost every European introduction were incorporated into the native tongues. Tonty (1688) tells us that the Cadodaquis on Red River of Louisiana called the horse "cavali," Spanish caballo.

Many tribes, however, applied names of their own coining, deriving them from the names of objects most nearly resembling the object to be named. A familiar example is offered by the Dakota name for horse. As the only animal domesticated among the Indians was the dog, the Santee and Yankton name for which is Shunka, the horse was called by the Santee, Shunk-tanka, big dog; Yankton, Shunka wakan, mysterious dog.

Again, the Cheroki, as Mr. Mooney informs me, before they met the European, extracted their only saccharine from the pod of the honey locust, using the powdered pods to sweeten parched corn and to make a sweet drink. Their name for Honey Locust was Kŭlsétsĭ, which name they applied also to the sugar of civilization.

Bearing the above facts in mind, it is a fair inference that if investigation shows that the Indian name for European sugar is the same as, or a derivative from, the name for maple sugar, and especially if the name of the latter be derived from the name of maple tree, we can hardly expect to find better evidence of the fact that maple sugar was a truly aboriginal production.

Frequent allusion is made in Tanner's Captivity to the manufacture of sugar by the Ojibwa, and on p. 294 (James Ed., N. Y., 1830) the Ojibwa term for Sugar Maple is given as Nin-au-tik, which is rendered "our own tree." The compound may possibly be from mitig, tree, and nin, our. (See Baraga Otchipwe Grammar.) It is, however, probable that Tanner's etymology is faulty and that the true derivation is given below. The River Maple is called She-she-gum-maw-wis, which is interpreted "sap flows fast." This etymology is also significant, since it clearly implies the ancient derivation of the tree's name from its sap. It is probable that the Indian's knowledge of the flow of the sap was had by the practice of tapping the trees for the purpose of sugar-making.

The Menomini name for the sugar moon, probably March, is given (p. 321) as Sho-bo-maw-kun ka-zho. It is very unlikely that the Indians would give a name to the sugar month unless sugar-making was of respectable antiquity among them, and was, moreover, aboriginal.

A letter from Mr. Beaulieu at White Earth, Minnesota, in response to a letter of inquiry, contains interesting and valuable information in regard to sugar-making among the Ojibwa, and I therefore take the liberty of quoting parts of it. He gives the Ojibwa word for maple sugar as Zeence-zee-bah-quod, pronounced sen-se-pah-qwot.

(Compare this with the Cree term below.) Derivation Zeence-zee, squeezed or drawn from; bah-quod, stick or wood. Hence the meaning, drawn from wood, or squeezed from wood or stick, which applies to the sap and the manner in which it is drawn from the tree by tapping in the spring.

Weesh-ko-bun is another term often used by the Indians, and more properly applies to the saccharine quality of sugar than the former word, as it refers to something palatable and grateful to the sense of taste.

Enin-ah-tig weesh-ko-bun is also employed. Enin, man; ah-tig, wood or stick; weesh-ko-tun, sugar. Hence, man stick sugar. This etymology contains a metaphorical reference to the manner the sap flows from the tree, as curious as it is suggestive. Doctor Hoffman informs me that this name particularly applies to sugar derived from the *Acer nigrum*, now considered as a variety of *A. saccharinum*, as the Indians say that the flow of sap from this tree is more plentiful than from any other.

Mr. Beaulieu states that the Ojibwa have a myth or deity connected with sugar. He also gives Zeence-zee-bah-quod-o-kay-ge-zis as the name for the sugar moon—March and April—adding that these are sometimes called Pay-bok-quay-dah-ge-mid, breaking snow shoe month.

He presents the following interesting facts with reference to the Ojibwa maple-sugar festival: "It has been and is yet with many the custom to join in a feast or sugar festival in the spring—that is, when the first sugar is made. The sugar-makers are invited to a lodge prepared for the occasion by the medicine man, who, when all have assembled, takes a small portion of the old sugar of the season before and the new sugar, mingles it together, at the same time muttering a prayer of thanks, and then hands a little to all who are present. Then he proceeds to thank, in a loud voice, the Great Spirit or Giver-of-Life for his good-will and invokes his aid and kindness to grant the a-nish-in-ah-bag (inferior braves or beings) a good and bountiful sugar harvest, etc. After this all are invited to partake of the feast prepared for the occasion, consisting, generally, of wild rice and game, etc., etc."

Lacombe, in Dictionnaire de la Langues des Cris (p. 254), gives the Cree name for sugar as Sisibâskwat, which is clearly a derivation from Sisibâskwatâttik, maple tree (p. 135). It is important to notice that the Cree distinguished their own sugar from the white

sugar of the European, calling the latter Sokaw (p. 254), which is evidently an attempt to pronounce the French or English word.

Mr. Hewitt informs me that the Tuscarora word for sugar is U-rĕⁿ'-nā'-krĭ', which signifies tree sap. It would thus seem that even in this tribe, which lived comparatively far south, the knowledge of the product of the maple tree must have antedated the knowledge of European sugar, though the North Carolina home of the tribe could scarcely have furnished the means for extracting the sap, at least, in any quantity.

Making due allowance for consonantal changes, the Oneida seem to have the same word for sugar—O-loñ-da'-ke-lĭ'.

Mr. Dorsey gives the Omaha and Ponka word for sugar as Jaⁿ-ni, Jaⁿ being wood or tree; ni, water or sap; thus, tree sap. The word for sugar maple is Jaⁿ-nihi, hi being tree or stock. The Kansa word also is Jaⁿ-ni; the Osage, Caⁿ-ni; the Iowa, Naⁿni, all apparently having the same etymology.

The Winnebago word differs somewhat, being Ta'niju'-rā, niju being water or rain. Hence the etymology would seem to be wood water or rain, the word apparently suggesting the idea of the rapid flow of the sap.

It would not be difficult, I believe, to bring forward much more linguistic evidence tending to show that the Indian names for sugar and maple sugar were usually the same, and that the terms for the latter were aboriginal, date from a remote antiquity, and were connected with the trees which produce their only saccharine. The evidence here advanced, however, seems to be sufficient. At all events, it appears to offer at least presumptive proof that the Indians were in nowise indebted to the European for their knowledge of maple sugar. Like the cultivation of the maize, the tobacco, the pumpkin, bean, and cotton alluded to above, the art of maple-sugar-making, simple as it was, was aboriginal, resulting from their own observation and inventive powers.

Jiváya Stariná (*Surviving Antiquity*).—In September–October of the current year the Ethnographic Section of the Imperial Russian Geographical Society will publish the first number of a quarterly with the above title. It will be devoted to the whole Slav race, wherever resident, and to the various ethnic stocks within the Russian Empire.

A FETISH-TOWN IN TOGOLAND.—"The great fetish-town, Dipongo, consists of nine huts, grouped in a circle round an india-rubber tree, and of these seven are occupied only by the wives and children of Jaopura. The fetish-hut shelters Jaopura's insignia as king and highest fetish priest of Adeli. Several gigantic parasols of native workmanship, covered with bright-colored European calico; a great, wonderfully carved Ashantee stool (the natives say Assanti) with bells, which he sends on ahead to every great assembly as a sign that he is going to appear in person; a remarkably wrought leather girdle, with iron bells sewed on in front, which none but Jaopura may wear; a barrel-shaped drum covered with leopard skin, which, unlike the other drums, is not beaten but stroked with the drumstick, which produces a peculiarly rattling noise, and various other fetish and royal insignia dangle, covered with dust, from the walls and roof or stand sprinkled with blood upon the floor.

"Between his two huts a broad path, the beginning of which is marked by two sacred tree trunks lying obliquely across it, leads to the great fetish in the wood, which I was not allowed to approach. Here are held the great fetish festivals, while the ordinary ceremonies—in which the killing of chickens, from the nature of whose death struggles a favorable or unfavorable answer is given to the questioner, plays the chief part—are carried on in the village itself." (Lieutenant Kling, commander of the Bismarckburg station, Togoland, in "Mittheilungen . . . aus den Deutschen Schutzgebieten, v. 3, No. 3, Berlin, 1890.)

SECRET SOCIETIES AMONG THE COAST INDIANS OF BRITISH COLUMBIA AND ALASKA.—The well-known Norwegian traveller, J. A. Jacobsen, is beginning to publish the ethnographical results of his travels in northwestern America, in "Das Ausland." The first article appeared in Nos. 14 and 15 of the current volume (pp. 267–9, 290–3), and treats of secret societies on the northwest coast ("Geheimbunde der Kustenbewohner Nordamerikas.")

Captain Jacobsen describes four of these secret orders, namely:

1. The Hametz or "biters," with three classes, the biters of men, the corpse devourers, and the dog biters.

2. The Pak-halla or Pak-kwalla, "medicine men."

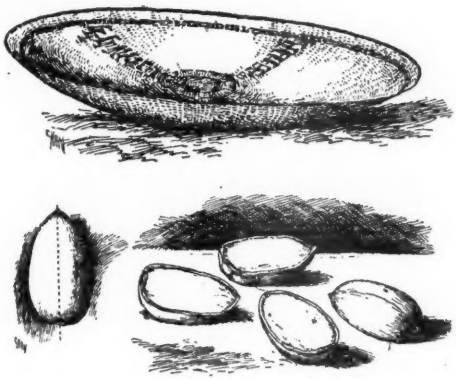
3. The Hatz-kwalla or self-torturers, peculiar to the Kwakiutl.

4. The Nuttle-mattla, who perform all sorts of buffoonery under the possession of the spirits.

ON THE NISHINAM GAME OF "HA" AND THE BOSTON GAME OF "PROPS."

BY ROBERT E. C. STEARNS.

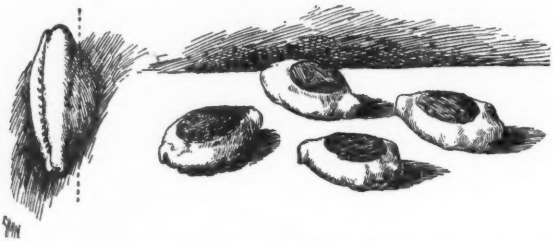
Stephen Powers,* in his description of the games of the Nishinam Indians of interior California, says: "The *ha* is a game of dice, played by men or women, two, three, or four together. The dice, four in number, consist of two acorns split lengthwise into halves, with the outside scraped and painted red or black. They are shaken in the hands and thrown into a wide, flat basket, woven in ornamental patterns, sometimes worth $25. One paint and three whites, or *vice versa*, score nothing; two of each, score one; four alike, score four. The thrower keeps on throwing until he makes a blank throw, when another takes the dice. When all the players have stood their turn, the one who has scored most takes the stakes, which in this game are generally small, say a "bit." As the Indians say, "This is a quick game, and with good luck one can very soon break another."



Fifty years ago a similar game was played by boys in Boston with dice made of the money-cowry, *Cypræa moneta*. The shells to the

* Contributions to N. A. Ethnology, Vol. III, p. 332, 1877. U. S. Geog. and Geol. Survey, &c.

number of four were selected as nearly as possible of the same size, and the backs ground down so as to expose the interior. The cavity thus made was filled with *red* sealing-wax. The game was known as "*props*" and the count was the same as in the Nishinam game with acorns, as described by Powers. The shells as prepared, or "props," were shaken in the hand and dropped or cast from the hand with a somewhat twisted motion of the wrist, so as to scatter them a little. When thrown, if the props turned up two sides one way and two the other, or two and two, the count was *one*—this was called a *nick;* if all four came the same side up, the count was *four*, and was called a "*browner;*" if the shells or props fell *three* one side and *one* the other, it was called an "*out,*" and the props were passed to the next player. The props continued with the same player until he made an *out*, and the *number* to make a *game* was agreed upon, before the playing commenced.



Occasionally, when the playing or throwing was on the ground, a shell would stand or lodge on one edge; this was called a "*cock,*" and the player was allowed to keep on, the "cock" not counting one way or the other, to his advantage or detriment.

The game of *props* was played by boys for marbles; subsequently it became an out-and-out gambling game and was played by men for money.

Cheating in this simple game was made possible and was practiced by filling the cavity, first with a portion of sealing-wax, then with some *lead*, then finally with wax, which concealed the *lead*. With these so-called loaded props the player could make a winning throw nearly every time.

Professional gamblers carried two sets of props the better to deceive their victims, and substituted a loaded set for a fair or not loaded set as opportunity permitted. Gambling by professionals

with props became so common at one time that the law intervened and the game and its implements were made unlawful and prohibited.

When we consider the fact that the Nishinam game of "*ha*" and the white man's game of *props* are one and the same, differing only in the character of the dice and in this respect only in the material or objects of which the dice were made, the question naturally arises whether the games so played had a common or separate origin.

It will be noticed that the time referred to, of prop playing in Boston, was many years before the great migration to California, in 1849, following the discovery of gold at Sutter's Mill, by Marshall, in 1848.

Returning to the questions, Did the pale faces of the Atlantic side learn the game from the red men of the west coast, or *vice versa?* Did the little invention have a separate and independent birth in each of these widely remote regions?

The fact of commercial intercourse between the people or individuals of these regions fifty years before the prop-playing date in Boston warrants the deduction that the knowledge of the game was borrowed of one party from the other, and also argues by implication against the presumption of independent origin.

On the fifth of June, 1791, we are told, the ship *Columbia*, from Boston, Mass., Captain Robert Gray, arrived on the west coast at a place called Clyoquot, near the entrance to the Straits of Fuca, and traded up and down the coast during the following spring and summer. It was while on one of these trading excursions to buy furs from the Indians that Captain Gray, on the 7th of March, 1792, discovered the Columbia river, which he named after his ship, the first that ever sailed up its stream. The report of this discovery and the valuable collection of furs Captain Gray carried to Boston created considerable excitement, and a number of expeditions were planned for making a settlement on the western coast.

It would occupy too much time and space to recite in detail the various ventures, expeditions, and vessels which followed the lead of the Columbia in the fur, hide, and tallow trade from 1791 to 1840, or to specify the various points touched at by the numerous vessels from Boston and vicinity during what may be called the first period or era of west-coast trade. In Dana's "Two years before the mast" we have an entertaining description of some of its

characteristics. Incidental to this early intercourse and traffic with the Indians, the pursuit of fur-bearing animals and the purchase of peltries led trappers and traders into the interior of California and the valleys of the Tulare, San Joaquin, and Sacramento, which in those days, as we are told, abounded with beaver, otter, and other animals.

Without seeking further to inquire whether the game of *ha* was played by the Indians of other tribes than the Nishinams, as specially mentioned, which is not improbable, it will be perceived that there was direct contact between the white men of the east and the California Indians of interior localities within the general region inhabited by the Nishinams and geographically related tribes.

The fur, hide, and tallow trade, in which Boston led the way, was largely controlled by its ships and ship-masters for many years, and this traffic was so generally identified with the vessels and men from that city that Americans, if not white men generally, were known as and were called "Bostons" by the Indians of the northwest—a name which is so applied to a limited extent along the coast even at the present day.

It is presumable that the game of *ha* was peculiarly a game of the interior Indians, for we may assume, with some show of reason, that if known or played by the coast tribes the latter would have used *some form of shell* for dice *instead of acorns*, and though not the shells of the money-cowry, which is an Indo-Pacific species, yet the always available "kol-kol" shells, *Olivella biplicata*, which were so extensively used for other purposes, could always be picked up on the beaches.

If the Indian had learned the game of the white man, then the coast Indians would have been the *first* to have learned it, and we have nothing to show that the maritime or littoral tribes had any knowledge of it.

The year 1791 was on the west coast made still further notable by the beginning of the sperm-whale fishery. In that year six vessels sailed from Nantucket and one from New Bedford, and this fishery and the incidental intercourse with fur traders and the "hide droghers," as the vessels engaged in the hide and tallow trade were called, continued for many years.

The whaling vessels often remained one or two years on a cruise, and during this period were frequently obliged to put into some port or to touch at some of the islands for fresh meat, vegetables,

water, and fuel. For many years after the sperm-whale fishery was at its height, Honolulu was the chief and general refitting and replenishing place; other groups and islands in the Indo-Pacific waters were sometimes visited. At these places and on such occasions the sailors amused themselves by collecting on the beaches or among the reefs, or obtained from the natives for some trifle—a plug of tobacco, perhaps—sea shells, conchs, cowries, &c., and other so-called curiosities. New Bedford, Nantucket, Provincetown, etc., were the chief sources from which the older collections in the museums and private cabinets were supplied. My own cabinet, commenced at the age of seven years, contained many of the shells of the coast of California and from the Pacific islands that had been brought from these regions by the hide ships and whalers.

Of the various shells inhabiting the Indo-Pacific islands, none are more common or abundant than the money-cowry, of which the props were made.

We may assume that as acorns were not available at sea, unless a stock was obtained from the natives expressly for the purpose, that some substitute would be found and used, and that such substitute would be some natural form, easily manipulated and conveniently at hand; and, further, that the more intelligent white man would improve upon the simple implements of the savage when he could do so with less trouble to himself than would result from exactly or specifically following the forms used by the Indians. The common familiar money-cowry furnished a ready substitute for the acorn, and the red sealing-wax, then in common use, an available substitute for red paint.

The foregoing, it will be seen, carries the implication that the whites learned the game of *ha* from the Indians. To sustain this view we may farther assume, and it seems to me reasonably so, that if the red man had learned the game from the white man the latter would not have been slow in playing it for all it might profit him in winning from the Indians anything the latter might possess that was of any commercial value; and we might expect to find some evidence of the white man's superior implements among the red man's possessions.

It may be noted in passing, as a matter of peculiar interest if not of importance, that no instance of the occurrence of any form of Indo-Pacific shell has been detected among the Indians of the west coast, or among the trinkets, etc., in Indian graves.

It may be remarked that the questions before presented are inferentially answered by what immediately precedes this, to the effect that the pale faces or "Bostons" learned the game of *ha* from the Indians of the west coast, and this also answers the question as to a separate and independent birth.

Another point bearing upon the question in a general way is this: the game of *props*, so far as I can learn, was restricted to a very limited area, viz., Boston and vicinity and that region around the coast of Massachusetts which had the monopoly or control of the west-coast fur, hide, and tallow trade and the sperm-whale fishery of the North Pacific waters.

In the solution of questions of this kind it would seem that an answer may sometimes be found by pursuing the same method that is found to be generally satisfactory in determining the relations or identity, say, of fluviatile molluskan forms; the locality or habitat of the specimens in hand being known or having been ascertained, then to trace out and follow up the drainage system to which said locality or habitat belongs or in which it is situated. Now, between the Pacific coast and the Atlantic seaboard a continuous stream of intercourse was in operation and its movement continued for about fifty years and prior to the great migration of 1849 and '50. This stream included a width extending from the Straits of de Fuca at the north and southerly to San Diego, a reach of over twelve hundred miles on the west coast, with tributaries or minor streams extending into the interior, while its debouchment on the Atlantic side was confined to the limited region heretofore stated.

NATIVE RACES OF THE PHILIPPINE ISLANDS.—Prof. F. Blumentritt has recently published an annotated nominal list of the native tribes of the archipelago, with an excellent colored map showing their distribution. He recognizes but two distinct races on the islands, the Malay and the Negrito.

Prof. Blumentritt states that in the extensive literature relating to the Philippine Islands there has heretofore appeared no comprehensive list of the races which populate the archipelago, owing to the fact that the attention of travellers and students has been chiefly devoted to the island of Luzon and the Visayas, to the neglect of Mindanao and Paragua. ("Las Razas indigenas de Filipinas," Boletin de la Sociedad de Geografia de Madrid, v. 28, No. 1, pp. 7–42, March, 1890.)

ABORIGINAL FIRE-MAKING.

BY WALTER HOUGH.

Twenty years ago Paul Broca remarked: "These three distinct things must not be confounded—the knowledge of fire, the means of utilizing it, and the means of procuring it."* This caution was addressed to students of primitive society, in reference to which theories have originated based on observed facts of development. The above order seems to be the logical one, but demonstration is possible only in the two latter stages.

The first stage is theoretic only; for no tribe has ever been found ignorant of the use of fire, and the Andamanese, who are in the stage of fire preservation, are the only people the writer has been able to discover unacquainted with some method of generating fire at will. †

Numerous fire-origin myths have been collected from peoples of widely different culture. Nine-tenths of these myths relate that fire was brought down from above, or from a place where it was monopolized by the cunning or theft of some man or zoömorphic hero. It is presumed that all fire-origin myths refer to the invention of some process to make fire easily. It is only necessary to mention the Prometheus myth as a type.

Many myths afford clues to the earliest apparatus for fire-making. Prometheus brought fire from heaven in a hollow reed. The cognate Hindu myth is more explicit, relating that the carpenter ground out fire from wood, and gives details of the compound machine used, which latter is found in every Hindoo temple. Kuchiya-Tama drilled fire from wood in early Japan; in China Suy-jin was the culture hero; Genos of the Phenicians taught men to make fire by wood friction, and so on through the list.

An addition to this body of evidence may be cited that carries the use of the simple drill farther back than probably any myth. Dr. Cyrus Adler, of Johns Hopkins University, has called my attention to the probability of the existence of the fire-drill among the non-

* Societe d'anthropologie, Bulletins, 2 s., V. 1870, p. 76.

† E. H. Man. The Andaman Islanders. Lond., 1883, p. 82.

Semitic aborigines of Babylonia. Prof. A. H. Sayce in the Hibbert Lectures* states that fire was produced in Babylonia, as in other countries of the ancient world, by rubbing two sticks one against another. Dr. Adler is inclined to think that the matter can be more definitely stated. The Akkadean word for fire god is *Gibil*, compounded of *gi*, which means reed, and *bil*, fire. This composition of the name points to the existence of a fire-making apparatus among the aborigines of southern Babylonia, of which the reed, *gi*, forms a part. This may have been used as a part of an upright drill like the Piute specimens collected by Major Powell, or after the manner of the Malays, by sawing one piece across another.

The following is a classification of the chief methods of fire-making by friction based upon the presumed order of development:

I. On wood (reciprocating motion) by—
1. *Simple two-stick apparatus.* Indians of North, Central, and South America; Ainos, Japan; Somalis, Africa; most Australians, &c. The most widespread method.
2. *Four-part apparatus: mouth drill, and two-hand drill.* Eskimo, some Indians, Hindoos, and Dyaks.
3. *Compound, weighted drill.* Iroquois and Chukchis.

II. On wood (sawing motion) — Malays and Burmese.

III. On wood (plowing or planing motion) — Polynesians; some Australians.

IV. Of minerals. (Percussion)
1. *With pyrites (or stone containing iron) and flint.* Eskimo and Indians of the North (Algonkian and Athapascan stocks).
2. *Flint and steel.* Modern and disused methods and appliances.

Besides the lens, mirror, and aerophore† there are pyrophores, the hydrogen lamp, matches, and various chemical and electrical methods that are beyond the scope of this paper.

There is a prevalent belief that to make fire by friction of two sticks is very difficult. Such is not the case. The writer can make fire in 10 seconds with the twirling-sticks and in five seconds with

* Origin and growth of Religion as illustrated by the Religion of the Ancient Babylonians, London, p. 180.

† American Anthropologist, i, 1888, p. 294.

the bow-drill. Captain John G. Bourke, U. S. A., furnishes corroborative testimony on this point* to the effect that the Apache can generate fire in less than 8 seconds. Most tribes make fire on wood in less than two minutes; if a longer time is consumed, it is probable that the people under observation are not properly prepared, or are practicing a waning art.

Generalizations with respect to fire-making have been made from the theoretical difficulties presented without recourse to a practical test. An experiment is a question put to nature, a fact which should not be forgotten by anthropologists as well as physicists.

The origin of the *culte de feu* is based on these theoretical considerations. "The difficulty, the impossibility almost, for certain tribes to produce fire for themselves makes it necessary to jealously preserve it; there is then nothing astonishing in the fact that it was respected and adored; and the appointment of Vestals charged with its preservation comes without doubt from the same idea." This is a late utterance by Sir John Lubbock.† It was adored, no doubt, as were other natural forces, because of its mysterious nature and origin. To its sacred and religious character, and not to the difficulty of procuring it, is due its preservation by special functionaries in a later stage of culture. The Vestals would have had no trouble to rekindle their fire. It was not their custom to moisten the sticks as does the Zuñi priest, according to Mrs. Stevenson, before making his sacred fire, possibly on the principle that what costs most is most valuable; or, more probably, because sacred fire must not be procured by the common method. Neither Eskimo nor Indian is careful to preserve fire, since a new spark can be obtained in half a minute. These tribes are far removed from primitive man, but it appears probable that when early man once learned the art he could obtain fire at will.

The retention of the wooden apparatus for so long a time among the different peoples is an interesting fact. In the case of many tribes familiar with quicker methods, this survival has doubtless resulted from religious influences. In several instances the green-corn dance, a cultus ceremony of our Indians, has brought the art down to our day, when otherwise it might have been lost. It is well known, too, that fire generated from wood is esteemed more efficacious by semi-cultured peoples. The reason for this belief

* American Anthropologist, iii, 1890, p. 61.

† A Conference upon the Savages. Toynbee Hall. London, 1887.

may be found in the respect and reverence for old customs—ancientism. The art has also progressed and there have been improvements in the apparatus, selection of wood, tinder, etc. No doubt fire can now be made more easily and in a shorter time than formerly.

Many travellers testify that they have observed various peoples make fire afresh by friction with sticks of wood. The most common way, by twirling one stick upon another, is well described by Pere Lafitau*: "The Hurons, the Iroquois, and the other peoples of North America do not make fire from the veins of flint, but rub two pieces of wood, one against the other. (Fig. 1). They take two pieces of

FIG. 1.—Simple two-stick fire-making apparatus.

cedar wood, dry and light; they hold one piece firmly down with the knee, and in a cavity which they have made with a beaver tooth or with the point of a knife on the edge of one of these pieces of wood, which is flat and a little larger, they insert the other piece, which is round and pointed, and turn and press down with so much rapidity and violence that the material of the wood, agitated with vehemence, falls off in a rain of fire by means of a crack or little canal which leads from the cavity over a match (of frayed cedar bark). This match receives the sparks which fall and preserves them for a long time and from which they can make a large fire by touching it to other dry materials."

Even the best descriptions, however, omit details essential to the

* Moeurs des Sauvages Ameriquains, 1724, vol. ii, p. 242–3.

success of the process. Few note, for instance, the great knack in twirling the stick. It is held between the palms of the outstretched hands, which are drawn backward and forward past each other almost to the finger tips, giving the drill motion, and at the same time a strong downward pressure is given. The hands, of necessity, move down the spindle; when they nearly reach the lower end they are quickly shifted to the top without moving the drill from the hole, and rotation is repeated as rapidly as possible. Very shortly a light-colored wood powder is ground off by the point of the drill and collects in the slot, Lafitau's canal. Soon the powder increases in quantity and begins to get darker; the smell of burnt wood is

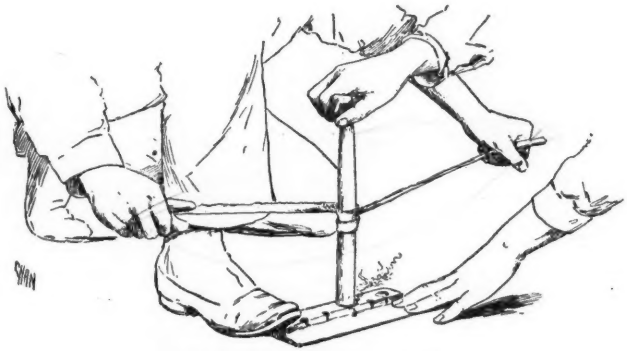


FIG. 2.—Eskimo two-handed fire drill.

speedily noticed and then smoke is seen. Probably when the next motion ceases there will be a little curl of peculiarly colored smoke, which shows that active combustion has begun. The mass of wood powder may now be shaken out of the canal.

At first it looks dead were it not for the thin line of vapor that comes from it. Gradually the fire spreads through it until it glows.

This semi-carbonized dust seemingly acts as a muffle to retain the increment of friction-heat until it attains 450° or higher. The dust must remain in an undisturbed heap; it is impossible to make fire without observing this caution.

In the case of the Eskimo compound drill the actual operation is similar to that in the simple drill described; the only difference is in the details of the mechanism which mark it as an improvement on the earlier form. (Fig. 2).

The Eskimo compound drill is of two varieties—one worked with a thong and hand-rest by two persons (Fig 2), and the other worked by one man with the aid of a bow and mouthpiece (Fig. 3). The apparatus consists of four parts, viz: the lower piece or hearth,

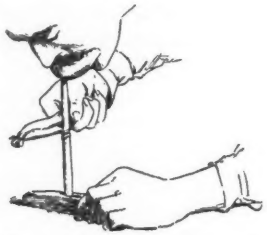


FIG. 3.—Eskimo mouth fire drill.

which may have fire-cups on the sides with a canal opening upon a flat step, or the holes may be bored on a central groove; the spindle; the mouthpiece or hand-rest with a stone bearing; and the cord which may be stretched on an ivory bow, or fitted with two

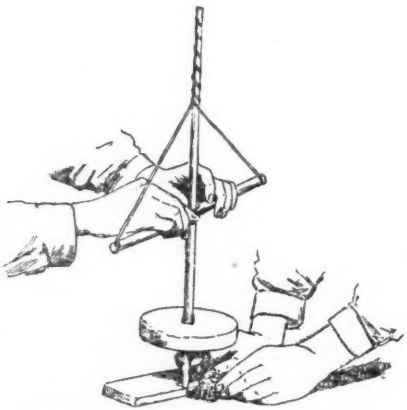


FIG. 4.—Iroquois pump-drill for making fire.

handles as the cord on the ancient Hindoo fire-drill. The bow and mouthpiece are not found south of Norton Sound, Alaska; the cord and hand-rest are exclusively used. At other points both

methods occur. The stepped variety of hearth also is found only in Southwestern Alaska, while the central holes on a groove are found from Labrador to Norton Sound, exclusively, and occurs, associated with the other, at the extreme southern range of the Eskimo.

The pump-drill (Fig. 4) is one that was used in making new fire in the white dog feast of 1888 by the Onondagua Iroquois of Canada. They are usually made of elm wood, and often the spindle was hewn from part of a sapling with its tap root forming the lower part. A mass of wood was left for a weight.

Mr. Wallace describes the sawing method thus: "A sharp-edged piece of bamboo is rubbed across the convex surface of another piece on which a small notch is first cut. The rubbing is slow at first and gradually quicker till it becomes very rapid, and the fine powder rubbed off ignites and falls through the hole which the rubbing has cut in the bamboo."* (Fig. 5).

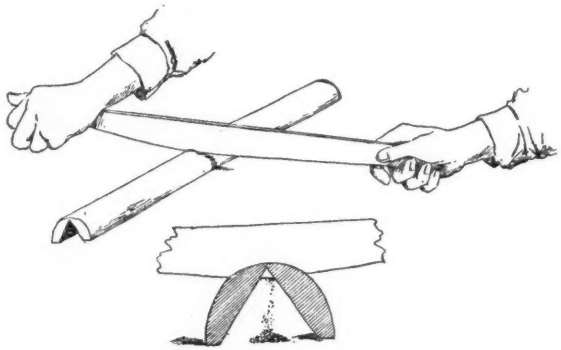


FIG. 5.—Fire saw. Section.

Two varieties of sawing have lately come to the writer's notice, one of which has marked a new locality in the distribution of this phase of fire-making. It has heretofore been observed at five points, viz: Among the Tungaras of British North Borneo (Daly), the Javanese (d'Almeida), the Karens and Chittagong Hill tribes of Burma (Dr. Luther and Mr. Lewis), the Malays of the islands (Wallace), and in Australia (Smyth).

*The Malay Archipelago. New York (1869) Harper's, p. 332.

It has lately been practiced at the village of Ubumkara in S. E. New Guinea. Mr. H. O. Forbes writes: "The operator first selecting a dry fragment of wood makes in it a split in which he inserts a peg to keep it agape; into this split he places a morsel of tinder plucked out of his girdle or skirt; he next cuts from his dry coil of rattan a short length, lays it on a dry leaf on the ground and places over it the tinder plug in the cleft stick; then placing his knee or foot on the end of the stick he pulls the rattan cord rapidly to and fro under it till the tinder ignites, when, by blowing gently through the cleft, he fans the spark into a flame. The whole operation is the most effective and rapid of any native fire-producing contrivance that I know."* Mr. Forbes' account is perhaps the first that has ever been published.

Mr. S. B. J. Skertchly describes another variant of the fire-sawing process in which the parts of the usual apparatus are reversed. The saw is set up on the ground and the convex side of a bamboo piece that bears a groove with a hole that communicates with the tinder placed on the upper concave side is slid rapidly along the edge of the saw. This is the common way among the Cagayu-sulu. The usual method, in which the sharp-edged saw is rubbed across a piece of bamboo, is practiced in Sulu, Perak, Selangore, and other places.†

This gives a distribution throughout the East Indies, beginning at the Asiatic continent and finding its way into Australia probably by Cape York. It will doubtless be found in the Malay Peninsula, Sumatra, the Celebes, and perhaps to the north in the Philippines. The writer was informed in 1889 that the sawing method is practiced also in Siam. The method is called the Malay or sawing method‡ and the type was founded on Wallace's description. It seems to be coincident with Malay influence. While there is little data to disprove this statement, it seems strange that the method was not carried further east by the Malayo-Polynesian wave of migration. The range of bamboo would seem to determine it, but both in Burma and Australia we find the parts of the apparatus cut out of wood.

The Polynesian islands are characterized by the plowing method of making fire, a variety of which is found also in Australia.

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* Proc. Roy. Geog. Soc., XII, p. 562.

† J. Anthrop. Inst. XIX, 4, May, 1890, p. 456.

‡ Smithsonian Report, ii, 1888–9, p. 569.

The plowing method (Fig. 6) as practiced in Samoa was described for the writer by Lieutenant W. I. Moore, U. S. N. The Samoans prepare a short cylindrical pointed stick and a larger billet of wood, on which a shallow groove is sometimes begun. The smaller stick is clasped between the hands at an angle of 45° and projected to and from the body along the groove in the lower piece on which the native kneels. At first he forces it along a range of 6 or 7 inches, till the wood begins to wear away and is pushed into a little heap at the end of the groove; then he gradually accelerates and moves with a shorter range until, when he moves the stick with great rapidity, the brown dust ignites.

The flint and pyrites strike-a-light is used somewhat as the flint and steel, with which process most persons are familiar.

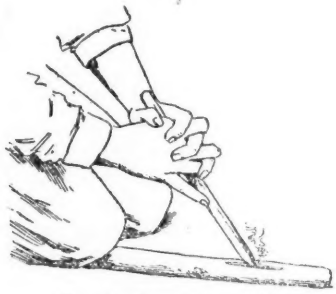

FIG. 6.—Samoan fire sticks.

Examination of many specimens of wooden fire apparatus shows that both the drill or upright, movable piece and the hearth or or lower piece are made of dry, inflammable wood, and, contrary to the common belief, quite often of pieces from the same tree. Wood that is "punky"—that is, soft from dry rot or worm-eaten—is preferable. This is the kind of wood spoken of by Festus and used by the Vestals: "Mos erat tabulam felicis materiæ tamdiu terebrare quousque exceptem ignem cribro ænis Virgo in ædem ferret." "It was the custom to bore into a plank of combustible wood upon which they had hitherto made fire, which a Vestal virgin received on a brazen sieve, which she carried immediately into the temple."*

* Festus: *Ignis vestæ.*

This kind of wood is not only easier of ignition, but it is ground off easily and more readily retains the heat generated by friction. In strong, skillful hands, however, fire can be made from wood that does not wholly meet these conditions, but there will be more failures than successes.

Woods vary widely in combustibility, depending perhaps on their density, coloring matter, or chemical constitution. For instance, it is practically impossible to make fire of black walnut; while dry, soft white maple, not decayed, is good for the purpose when drilled with the bow. The vascular, starchy, flowering stems of plants have always been favorite fire-generating material.

The Eskimo make use of nearly every kind of dry wood, because the compound drill enables him to give strong pressure with high rate of speed, thus generating enough heat to ignite wood that is quite intractable by the simple two-part drill. This invention followed from the conditions of the Eskimo's frozen home, where driftwood is his main dependence and choice is restricted. The Eskimo, however, always selects the best wood at hand, thus showing that he appreciates the advantages of proper material.

The flint and pyrites method is thought to compete with the twirling sticks for priority of invention. The antiquity of the latter has been set forth. By one theory its distribution is interpreted to mean that it was the heritage of the human race before it separated into groups. By the other theory it was rediscovered many times—a natural suggestion, for the materials are always at hand. The flint and pyrites method seems to be indicated by the few lumps of pyrites found in prehistoric stations in England and on the continent. However, it cannot be affirmed that the pyrites so found was used for fire-making. In this connection it would be of interest to know whether a piece of pyrites and scraper-like piece of flint have ever been found close together in conditions implying remote antiquity.

The strongest argument against the use of the pyrites method in a very primitive state of society is that it presupposes the selection, preparation, and preservation of tinder. Wooden fire-sticks, on the other hand, form their own tinder. In the pyrites strike-a-light the sparks are struck off at so low a heat that they will not inflame any except very "quick" tinder. With good tinder, however, the pyrites method is more expeditious, while the apparatus is more compact, and hence is an improvement following the line of elaboration.

Apparently preceding the flint and pyrites in the usage of several tribes is the method of striking two pieces of pyrites together, said to have been practiced by the Arctic Eskimo of a few localities.

Another origin of fire-making has been discussed. It is stated by several writers that while working flint a spark may have fallen into dry material, and that in this manner early man received the suggestion of fire-making. But the sparks produced by knocking two pieces of flint together will not, to the best of my knowledge from experiment, inflame tinder.

In view of the foregoing facts, it may be said with regard to the probable origin of fire-making: 1. That the selection of two sticks of wood for fire-making is more probable and natural than the use of iron-stone and flint. 2. That fire-making by means of sticks is easy, and hence probably came first in order of time. 3. That the pyrites method is more complex, and hence by the laws of invention comes later. It is unnatural that an expeditious mode of kindling fire afresh by flint and pyrites should have been supplanted by a less facile method. Inventions do not retrograde. Numerous cases may be cited where flint and steel have superseded the fire-sticks, but none show the opposite order of procedure. Dr. Tylor concludes: "To sum up now in a few words the history of the art of making fire, it appears that the common notion that the friction of two pieces of wood was the original method used has strong and wide-lying evidence in its favor, and that very little can be alleged against it." *

Apparently the Polynesian plowing method and the sawing method illustrate the most simple forms of friction apparatus. A plausable supposition bearing on this plan is that man got the hint from nature by observing the rubbing of two dry branches in high winds. The Polynesian method has the following in its favor: With one stick a furrow can be plowed on another without the intervention of a knife or other tool to cut a groove or a hole in which to start a drill, and hence it may have been invented during the earliest times. Its very simplicity renders the tool more difficult to work; for, in a wind, fire-making would be almost impossible. Again, when the dust collects at the end of the groove, the violent movements at the last moment are liable to scatter it. In the case of the rotary drill this is not so, the ground-off dust being kept in the canal. In the sawing plan, the preparation of the

* Early History of Mankind, p. 260.

knife, cutting the groove, placing the tinder underneath for draft, imply a more highly differentiated invention.

The rotary drill is the simplest aboriginal fire-making apparatus. Major Powell's three stages of culture may be defined by the kind of fire-apparatus used: 1. Savages make fire with two pieces of wood; 2. Barbarians with flint and steel or pyrites; 3. Civilized man by chemistry.

Since writing the foregoing the author has read Mr. Sidney B. J. Skertchly's paper on "Fire-making in North Borneo," in the May number of the Journal of the Anthropological Institute of Great Britain and Ireland.

In this communication the first complete description of the *best api* or fire-syringe is given; the names of the parts, the moulds used in casting the cylinder, the measurements, etc.

All the natives of this part of Borneo use the well-known fire-drill. Mr. Skertchly has noted an essential point in the lower member of this appliance—the groove cut down the edge to collect the dust in which the fire rises.* Prof. A. C. Haddon, in the discussion following this paper, pointed out that the slot cut in the drill hole was not made by the Torres Straits Islanders, nor by the natives of Queensland, and therefore is not essential. Professor Haddon is right, in a sense. Fire *can* be made on a plane surface without groove, but the difficulty is so great that it is almost prohibitive, and the slot is essential to quick and easy fire-making.

The writer has made fire without the slot, but finds it necessary to employ the compound drill, and to keep the parts from binding or jarring. He has rarely seen pieces of fire-making apparatus without the slot, groove, or a substitute for it. One of these was a model of a Hindoo sacred fire-drill, sent from Oxford Museum to the United States National Museum by Mr. Henry Balfour. The Victoria drill figured in R. Brough Smyth's great work,† has fire-cups directly on the edge of a rounded piece, so that when the drill begins to cut the wood-meal falls down over the edge in a heap as in the slot. Often connecting holes perform this important office.

A spindle of large diameter, with the outline of a low, flat arch (Tudor arch) at the abrading end, will not disturb the ring of dust that forms around its circumference (the difficulty with the unslotted

* See Smithsonian Report, ii, 1888, p. 557.

† The Aborigines of Victoria, i, p. 393.

hole), and if the ignition point is reached before the spindle cuts very deep, the experiment will be successful. This sort of drill has to be worked by a cord or bow.

Those who have previously written on this subject are to be pardoned, because they had no knowledge of the exigencies of the process and the minute particulars required. Drawings also were not accurate in the small points which were left to the artist. I have known professional draughtsmen to omit the slot from a drawing of a fire-drill. This has doubtless often led to misconceptions as to the position of the fire-hole.

Mr. Skertchly carefully describes the sawing method and notes an interesting variation.

Fire is sometimes made in Borneo by striking a bit of broken crockery on a bamboo, which requires great skill.

A plate of excellent figures accompanies Mr. Skertchley's article, and his paper was illustrated by a series of photographs taken by Mrs. Skertchly, showing the methods of obtaining fire from the instruments described. Several drawings of fire-syringes were also exhibited by members of the institute. In the discussion, the veteran Dr. Rae gave an account of Eskimo fire-producing, which terminated this extremely interesting *seance*.

The above paper was read before the society January 4, 1890. In the course of his remarks Mr. Hough exhibited various primitive apparatus for fire-making which are contained in the National Museum collection and are illustrated above. From several of them he succeeded in creating a flame.

CANNIBALISM IN NEW IRELAND.—Cannibalism is still generally practised and freely acknowledged by the natives of the island of New Ireland, now called New Mecklenburg by the Germans, who have established a "protectorate" over it. Strangers—that is, people from a different village or tribe—only are eaten, and each person who partakes of the feast has to pay a certain sum of shell money to the owner—that is, the man who killed the "game." (Count Joachim Pfeil, in Verhandlungen der Gesellschaft für Erdkunde zu Berlin for March, 1890.)

CUSTOMS AND BELIEFS OF THE TRIBES OF SOUTH AFRICA.—A long and interesting general account of the ethnography of South Africa has recently appeared in the *Revue Scientifique* ("Coutumes et croyances des tribus de l'Afrique australe," par J. Macdonald. Rev. Sci., v. 45, Nos. 21, 22, May, 1890, pp 642–8, 679–87).

This article, which appears to be a compilation, although the sources of information are seldom referred to, after giving a general sketch of the tribes dealt with, their names and social organization, proceeds to describe them in detail under the following heads: Birth and posterity; puberty, including the ceremonies of circumcision and initiation; marriage; sickness and death; property and inheritance; fire-making; food; hunting and fishing; agriculture; warfare; religion; oaths; salutations; arithmetic; measure of time; games and dances; magic and divination, and rain-making.

BUSHMAN ART.—G. Weitzecker sends to the bulletin of the Italian Geographical Society copies of some interesting examples of Bushman rock-paintings recently discovered by himself in Basutoland. These represent, first, a man milking, an eland grouped with four apes, two elands together (one of these is remarkably good), and a large group of eighteen figures representing a number of Bushwomen, with their children, flying from a party of Matabele Kafirs. This picture is full of life, and, according to Mr. Weitzecker, illustrates many important ethnographical details, which he describes fully in the text. (Bollettino della Società Geografica Italiana, April, 1890.)

"EXOGAMY" IN NEW BRITAIN.—The natives are divided into two marriage groups, called "Maramara" and "Pikalaba." Marriage of two persons within one of these groups appears to be punishable with death to the woman and a heavy fine to the man. A person of one group can thus only marry one of the other, and the children belong to the mother's group.

Both groups show great reverence for an insect, a species of Mantis, and any one who should kill or injure one of these would be severely punished. (Count Joachim Pfeil in Verhandlungen der Gesellschaft für Erdkunde zu Berlin, March, 1890.)

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BOOK NOTICES.

Mehmed's Brautfahrt (Smailagic Meho): Ein Volksepos der südslavischen Mohammedaner. Aufgezeichnet von Dr. Friedrich S. Krauss. Deutsch von Carl Gröber. Wien, Alfred Hölder, 1890. 16 mo., 130.

This is a German metrical translation by Captain Gröber, an officer in the Austrian army, of a epic poem of the Mohammedan Slavs of Herzegovina, taken down from oral recitation by Dr. Krauss, the distinguished South-slav specialist. Among the secluded valleys of the upper Balkan peninsula—as in the remote districts of Ireland and Scotland—there are still old men, the descendants of the bards and minnesingers of the middle ages, who keep alive the memory of the past by the recital of long heroic poems which have been handed down traditionally through centuries. Among the Slavs these poems are all in a monotonous decasyllabic meter, without rhyme, and the singer accompanies himself on a sort of guitar (*gusla*), whence the generic name Guslar songs (Guslarenlieder) applied to the compositions. They are frequently of great length—this particular one occupied six hours in the delivery—and end with a few comic verses having no connection with the subject of the poem itself and intended to put the hearers in a good humor. A wealth of such material exists in the peninsula. The old man from whom this was obtained claimed to know a hundred and fifty such poems.

Unlike most of its class, the story is told from the standpoint of the proselyted Slavs, who appear to have become as intensely Mohammedan as any of their Moslem conquerors. By careful research the translator has ascertained that the poem has for its historic groundwork an engagement between the Turks and Christians which occurred in 1657, at no great distance from Budapest, the capital of Hungary, which at that time was all in the hands of the Turks. Briefly told, the story is as follows: Mehmed, a young officer, is on his way, accompanied by a single attendant, to receive his commission from the Pasha of Budapest. They meet a party of soldiers in charge of a Mohammedan girl who has refused the hand of the Pasha, and is now by his orders to be sold as a slave to a general

of the hated Christians in Wallachia. Mehmed determines upon her rescue, and the two men fall upon the hundred soldiers and slaughter them in good old knightly style, secure the maiden, and return with her to her home in Budapest. She of course falls in love with her deliverer and agrees to marry him, when Mehmed compels the unwilling minion of the Pasha to draw up the marriage contract, and then sets out for the south to collect his friends to escort the bride in proper fashion to her new home. They return to the number of twelve thousand footmen and fifteen thousand mounted warriors and are received in Budapest with princely hospitality. The festivities last several days, when young Mehmed and his train start on the return home with his bride. In the meantime, however, the false Pasha has sent a letter to the Wallachian general advising him to assemble his forces and cut off the party. Mehmed advances to the bridge of the Klina, where he encounters the whole host of the Wallachians, who have already engaged his advance guard. A terrible battle ensues, lasting three days, with the result that the Christian army is cut to pieces and its general becomes a prisoner in the hands of his youthful rival.

The story is well told and gives a vivid picture of a period in the long struggle between Turk and Christian, still going on in the same region, when every man's trade was war, and life was a carnival of blood, rapine, and drunkenness.

JAMES MOONEY.

"*Essai d'une classification des races humaines, basée uniquement sur les caractères physiques. Par M. J. Deniker.*"—[*Bull. Soc. d' Anthrop. de Paris, xii, 1889, 320–336.*]

The classification of mankind by race has not always proceeded upon the characteristics which truly constitute race. A familiar example is presented in the term Bantu for Africa and Algonkin for America. Every one knows that in the present state of ethnology these are linguistic words. Race, on the contrary, means blood. To our thinking, whenever and wherever a group of human beings have been isolated long enough to render a set of physical characters peculiar to themselves fixed and hereditable, then and there you have a race of men. In the modern commingling of our species incident to commerce a pure race is no longer possible; but many believe that it was not always thus. Between the pristine group and

the centripetal period of modern times there is believed to have been a long age in which centrifugal forces held sway, segregating men and fixing their characteristics. Furthermore, it is held by many, and among them by M. J. Deniker, that the modern period has not endured sufficiently long to obliterate the traces of these ancient pure races. Consequently, in the Bulletins de la Société d'Anthropologie de Paris (xii, 1889, 320–336), he lays down a new classification of the races of men based solely on physical characteristics. There are thirteen of these races, as follows:

I. Bushman (Koi-Koi). Woolly hair, yellow skin.
II. Nigritic. Woolly hair, black skin.
III. Melanesian. " "

IV. Negrito. Frizzled hair, black skin, depressed nose.
V. Australian. " " "
VI. Ethiopian. " " "
VII. Melanochroi. Wavy hair, skin brunette, hair black, eyes dark.
VIII. Xanthochroi. Wavy hair, skin rosy, hair blonde, eyes light.

IX. Uralo-Altaic. Straightish hair, skin white, lips thin, nose narrow.
X. Aino. Straightish hair, skin white, lips thin, nose wide.
XI. Indonesian. Straightish hair, skin yellow, lips fleshy.

XII. Mongoloid. Straight, coarse, smooth hair, skin white-yellow.
XIII. American. Straight, coarse, smooth hair, skin reddish-yellow.

The physical characteristics of each of the thirteen races are given, and the modern types under each race shown:

	Types.
I. Bushman. Yellow, short, steatopygeous .	*Bushman.*
II. Nigritic. Wide nose, straight or flat; lips projecting, forehead bulging, divided into:	
a. Dolichocephalic, flat nosed, prognathic, and salient nosed, tall and little prognathic	*Negro.*
	Bantu.
b. Brachycephalic, short . . .	*Akka.*
III. Melanesian. Nose turned up, large at the end, supraciliary arches prominent . .	*Melanesian.*
IV. Negrito. Brachycephalic, short, hair meagre,	*Negrito.*

	Types.
V. Australian. Dolichocephalic, short or medium stature, very hairy	*Australian.*
VI. Ethiopian. Skin very brown, nose salient.	
a. Tall, nose straight or aquiline .	*Bedja* (Galla, Foulbe, Nubian).
b. Short or medium stature, nose retreating	*Dravida.*
VII. Melanochroi.	
Mesocephalic, straight nose, medium height.	*Indo-Atlantic* or *Aryan.*
Dolichocephalic, nose curved, pointed, aquiline, occiput prominent	*Arab.*
Dolichocephalic, nose straight, narrow at the end	*Berber.*
Brachycephalic, nose hooked, narrow at the end, hair much frizzed and abundant .	*Assyroid.*
Brachycephalic, nose straight, fine or at times retroussé; short of stature . . .	*Rhetian* or *Celto-Ligurian.*
VIII. Xanthochroi.	
Dolichocephalic, tall, hairy . .	*Norse* or *Kymri.*
Brachycephalic, medium stature, little hair .	*Karelian.*
IX. Uralo-Altaic.	
a. Nose retroussé, hair blonde . . .	*Souomi.* (W. Finns).
b. Brachycephalic, brown hair . . .	*Lapp.*
c. Mesocephalic or dolichocephalic, nose straight, gross	*Ugrian* (Ostiak-Samoyède).
d. Brachycephalic, nose straight, gross,	*Turk* (Turanian).
X. Aino. Wide nose, very hairy, dolichocephalic,	*Aino.*
XI. Indonesian.	
a. Hair quite wavy, skin olive brown . .	*Polynesian.*
b. Hair quite straight, skin yellow-brown .	*Malayo-Indonesian.*
XII. Mongoloid.	
a. Brachycephalic, nose narrow, fine face, round, medium height . . .	*Mongol.*
b. Brachycephalic, nose gross, face elongated, medium height . . .	*Tungus.*
c. Dolichocephalic, face round, short . .	*Eskimo.*

XIII. AMERICAN.

		TYPES.
Brachycephalic	Nose aquiline, tall or medium height . .	*Red Skin.*
	Nose straight or curved a little, short of stature .	*Indians of the South.*
	Nose straight or curved a little, tall . . .	*Patagonians.*
Dolichocephalic.	Nose straight, frequently retroussé, short . .	*Paléo-American* (Fugian-Botocudo).

M. Deniker has worked out the system with great elaborateness. It should be compared with those of Welcker, Friedrich Müller, Haeckel, Topinard, Flower, and especially with Keane's classifications in Stanford's Compendium, Chambers' Cyclopædia, and in his criticisms of ethnographic volumes in *Nature*.

O. T. MASON.

COLLECTIONS OF THE MISSOURI HISTORICAL SOCIETY.—Among the many valuable collections of archæologic material in this country is that preserved in the Missouri Historical Society rooms at St. Louis. This series of objects is especially rich in implements of chipped stone, obtained mainly from the middle region of the Mississippi, with St. Louis as a center. There are eight or ten thousand specimens of this class and these have been culled from at least ten times that number. They were brought together mainly through the efforts of Mr. O. W. Collett, the present custodian, whose appreciation of the requirements of science in such matters has given them exceptional value. Very many were collected by his own hands and nearly all are supplemented by records of locality and manner of occurrence. They are therefore not an assemblage of strays, that serve only to perplex the student, but constitute a body of scientific material valuable now and available to future generations.

Much of the value of this collection and of the success of the Society are due to the intelligent direction and generous assistance of Col. Geo. H. Leighton, president of the Society.

W. H. HOLMES.

NOTES AND NEWS.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.—The American Association for the Advancement of Science met in the city of Indianapolis, August 19–26. The meeting was well attended, although it was observed that the large cities of the west were numerically but meagerly represented. The hospitalities extended by the city were most flattering and will long be remembered by the Association. The magnificent State-house was placed at its disposal and made a most satisfactory place of meeting.

The officers of Section H, Anthropology, were Dr. Frank Baker of Washington, Vice-President; Dr. Joseph Jastrow of Madison, Secretary; Dr. Charles C. Abbott of Philadelphia, Councillor; Prof. E. T. Cox of New York, Prof. O. T. Mason of Washington, and Mr. A. W. Butler of Brookville, Indiana, members of the Sectional Committee. The address of Dr. Frank Baker appears in this number of the ANTHROPOLOGIST. The papers read were as follows:

Indian Origin of Maple Sugar. By H. W. Henshaw.

Fort Ancient. By W. K. Moorehead.

Aboriginal Stone Implements of the Potomac Valley. By W. H. Holmes.

Suggestion for a Pan-American as Precursor to an Universal Language. By R. T. Colburn.

Dialectic Studies in the Swedish Province of Dalecarlia. By J. Muller.

Notice of a Singular Earth-work near Foster's, Little Miami Valley, Ohio. By F. W. Putnam.

Exhibition of Diagrams of the Brains and Medisected Heads of Man and a Chimpanzee. By Burt G. Wilder.

Peculiar Effects of One-sided Occupations on the Anatomy and Physiology of Man. By J. Muller.

Exhibition of a Bone Image from Livingston County, N. Y. By C. C. Abbott.

Exhibition of Gold Beads of Indian Manufacture from Florida and New Jersey. By C. C. Abbott.

A Study of Mental Statistics. By J. Jastrow.

Arts of Modern Savages for Interpreting Archæology. By. O. T. Mason.

The Form of the External Ear. By H. D. Garrison.

Preliminary Steps to an Archæological Map of Franklin County, Indiana. By H. M. Stoops.

The Relation of Mind to its Physical Basis. By Edward D. Cope.
Remarks upon the Mounds of Sullivan County, Indiana. By J. W. Spencer.
On the Atbatl or Spear-thrower of Ancient Mexico. By Zelia Nuttall.
On an Ancient Hearth in the Little Miami Valley. By F. W. Putnam.
The Evolution of a Sect. By Anita Newcomb McGee.
On Obsidian Implements of California. By H. N. Rust.
The Basket-mortar of Southern California. By H. N. Rust.
The Adze. By H. N. Rust.

Besides the Vice-President's address the chief papers may be thus characterized: Mr. Henshaw took the ground, from a large study of the literary resources, that the Indians originated the art of maple sugar making. Mr. Moorehead has most carefully examined the old Fort Ancient and written a volume about it. The communication was a resumé of the work. Mr. Holmes gave an account of his explorations of aboriginal bowlder quarries and work shops in the District of Columbia. This is the best account of such work we have had. Mr. Putnam gave an elaborate account of his last year's work on the Little Miami and in central Ohio. The occurrence of burnt clay in large masses, and in many varieties, is one of the greatest enigmas Mr. Putnam has encountered in his exploration. Professor Jastrow's paper was based upon the results obtained from a large class of young men and young women who were asked to write out extempore one hundred words. These lists compared and collected form the basis of Dr. Jastrow's studies in six trains of thought—mental idiosyncrasies, &c. Professor Mason's paper called attention to the absolute necessity of studying modern savages to get a proper conception of the data of archæology. Dr. Cope's discussion was based on his well-known theory of consciousness in evolution. The organism, on this theory, is rather the servant of the mental side of man than its creator and ruler. Following up the studies of Professor Mason on the Eskimo throwing stick, Mrs. Nuttall, with great patience, has worked out the ancient Mexican spear-thrower seen so frequently in the Kingsborough and other codices. Mrs. McGee gave a detailed account of the origination and history of one of the small religious communities or rather sects of our country.

The next meeting of the Association, and consequently of the Section, will be held in Washington, but the time has not yet been fixed.

O. T. Mason.

ORIENTAL CUSTOMS OF COURTESY.—In a valuable contribution to the July number of THE AMERICAN ANTHROPOLOGIST on "Customs of Courtesy," Colonel Garrick Mallery made allusions to the customs of the Arabs and the Israelites. I venture to offer a few remarks on this subject.

In ancient Israel the most common salutation was simply *shalom*, a word usually translated 'peace,' but carrying with it the general idea of 'welfare.' (See II Kings IV, 23 and 26.) It has been suggested, and the suggestion has much in its favor, that the passage relating to Joseph's brothers (Genesis XXXVII, 4), 'they hated him and could not speak peaceably unto him,' means 'they would not salute him.' In Judges (XIX, 20) and I Chronicles (XII, 18) the same form is employed. In I Samuel (XXV, 6) we find the expression 'to inquire after the peace' translated in the authorized version by 'to greet;' this is used when it is desired to indicate that the greeting was sent by a messenger or ambassador. The same phrase occurs frequently in the Assyrian inscriptions. A different form of salutation occurs in the book of Ruth (II, 4) where Boaz says to the workmen, 'The Lord be with you,' and they reply, 'The Lord bless thee,' (See also Psalm CXXIX, 7.) From a number of biblical passages we know that the salutation was accompanied by a profound obeisance.

Among the modern Jews where a Hebrew salutation is used it is generally the same as that of the Arabs, 'Peace be with you.' In the Sephardic (Portuguese) congregations the ritual salutation is that employed in the book of Ruth. Among the German Jews when a visitor entered the house the host greeted him with 'Blessed be he that enters,' to which the visitor replied, 'Blessed be he that is found.'

It may be worth noting that even now salutation in the East is a cumbersome affair. If two Arabs who are in a hurry approach one another and desire to talk on some matter of business, they will commence to shout to one another about their affairs when some distance apart. As soon as they actually meet they drop the business and salute.

Colonel Mallery stated that "Moslems, while scrupulously saluting the meanest of their own communion, refuse all friendly greeting to the Jews." This assertion is not quite correct. The usual Moslem greeting is, 'Peace be with you.' This may be offered only to a Moslem, and is denied all *kafirs*, whether they be Christians or Jews. The Moslem will, however, accost a *kafir* with 'May your

morning be good,' or, 'May your day be happy,' and will receive the reply, 'May your morning be happy and blessed,' or, 'May your day be happy and blessed.' I am not able to verify the statement that if a Moslem say by inadvertence to a *kafir*, 'Peace be unto you,' that he will add, 'Death to you.' I am also doubtful about the statement, "Where the Jews are in power they give no salute whatever to one of the Goim (non-Jews), but scowl at him." I have never heard of any community where this practice is followed; and the description "where the Jews are in power" is not sufficient to enable one to define the locality with any degree of accuracy.

CYRUS ADLER.

IROQUOIS SUPERSTITIONS.—When wampum belts were found wet and bedewed it was taken as an omen portending the death of a chief or sachem.

In the Council for Condolence and Installation, when the veil, composed of skin robes, was hung across the Extended House to divide the two international phratries from each other, and during the singing of the so-called "Six songs," if a chief or chiefs wept at the weird, touching lament, it was solemnly passed from mouth to mouth that the ones so affected would be the next in the body of councilors to die.

Healing herbs and "medicine" (anything of an U"-tke$^{n'}$ or supernatural nature used as a charm or amulet) were not gathered in the season when fire-flies flourished, because witches and wizards went about in the dark emitting sparks of fire, and so it would have been difficult to distinguish one from a fire-fly. Moreover, if a wizard or witch saw any one gathering herbs or "medicine" without being detected, the virtues of the herbs were destroyed. The habitat of the medicinal plants would thus be discovered, and the plants would then be destroyed by the witches and wizards.

Disease or pestilence was said to be supernaturally subtile, monstrous, and *faceless*, being in collusion with all manner of evil spirits and daimons. The false-faces having wry-mouths were and are still invoked to aid in driving away disease and evil spirits. There are annual and special expulsions and exorcisms of sickness and daimons. In the Iroquoian Genesis-myth, Ha-tu"-i', who seems to have been the god of disease and death, promises, for sparing his life, to aid Earth-Growing in benefiting mankind in sickness, if they would only take on his form and make a feast in his honor.

Small dogs, particularly those having a spot, commonly black or yellow, on each eyebrow, and causing them to appear to have four eyes, are said to be more subtile in perceiving the approach of witches or wizards than other kinds of dogs.

The howling of a dog portends a death in the family to which the animal belongs.

The continued barking or howling of a dog without apparent cause indicates the approach of a witch or wizard from the direction which the dog faces while howling.

A large, bright light seen on the roof of a house was said to be an omen that death would soon visit that house.

When the moon was in eclipse guns were fired, dogs urged to bark, and even beaten to cause them to howl, loud and continued shouting and wailings were kept up by the people, to frighten and drive away the mythic fire-dragon that was supposed to be swallowing the moon—the grandmother of the race of mankind.

When ducks and geese remained long in the water it was taken as a sign that there would be showers of rain accompanied by wind for three days.

If a rock or stone was found wet or bedewed with moisture it was a sign that rain would fall the next day.

If the houses of the muskrat were made thin it was a sign that the coming winter would be mild; but if they were lined a cold winter was predicted; if triple-lined a most severe and rigorous winter was expected.

If the deer pelts were thin and the hair on them was short a mild winter was indicated, and, conversely, thick skins and long hair indicated a severe winter.

If the bears began early to embed themselves in lairs well lined with leaves a long and severe winter was indicated.

After contact with a corpse a person would bruise the leaves of the common plantain (*Plantago major*), put them into water, and wash his eyes and face with the decoction in order to cleanse his eyes and face from the evil influence left by the ghost of the corpse, as it would not be well for a sick person or child to be seen by a person who had neglected the purification.

A small, white, perennial plant with yellow flowers is hung up in the house to ward off ghosts.

If it hailed much in the fall of the year it was said that there would be an abundance of all kinds of nuts and fruits the next year.

It is said that chipmunks are descended from snakes, and the common chimney swifts from crabs. J. N. B. HEWITT.

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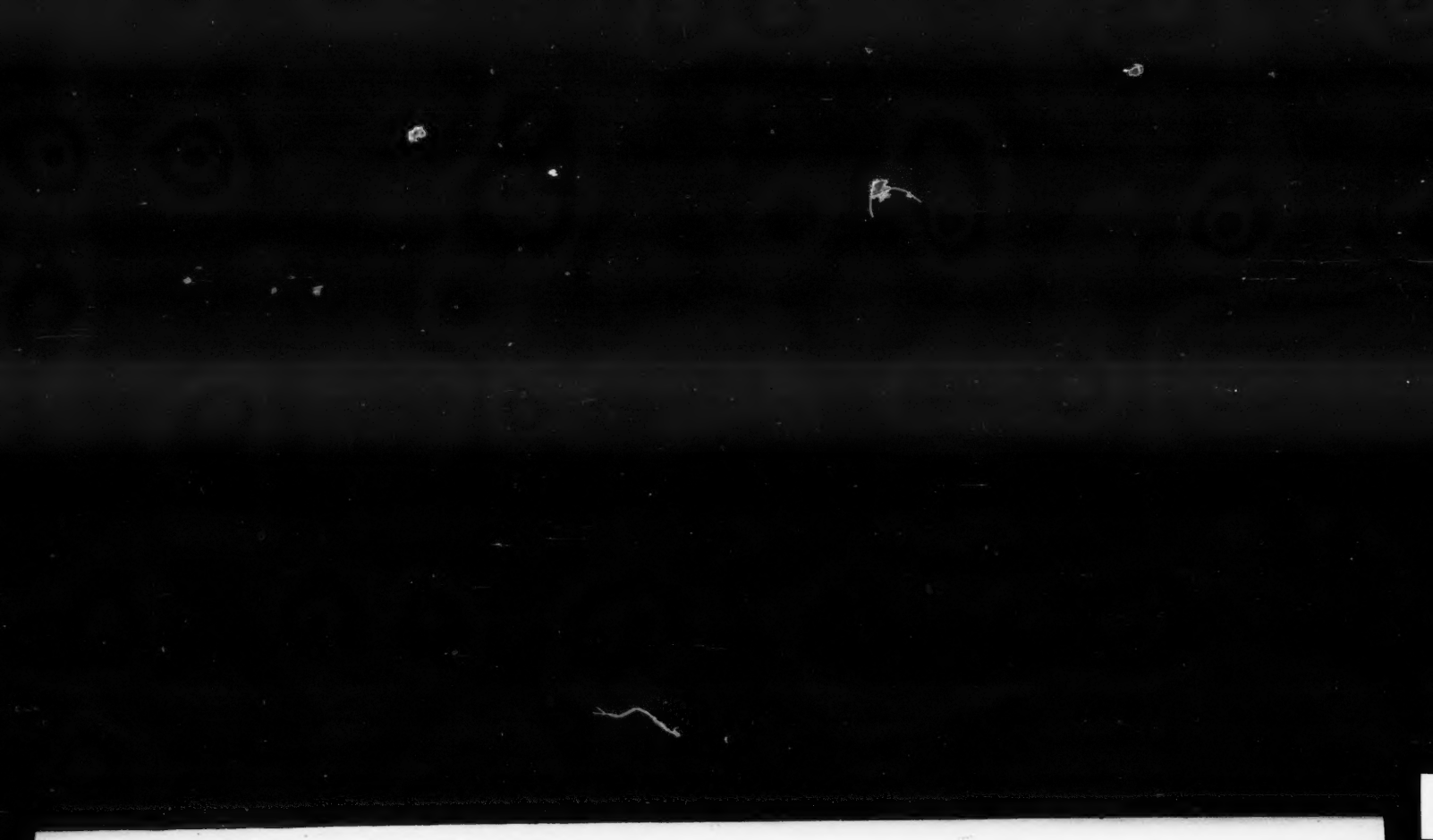
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